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the glass industry

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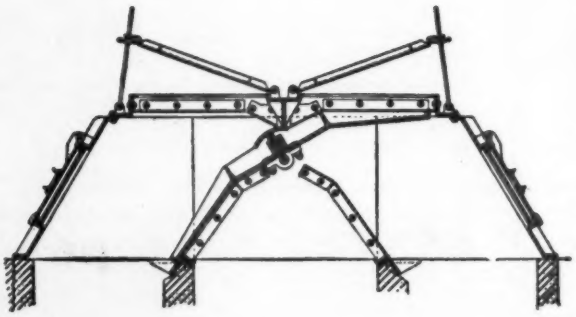

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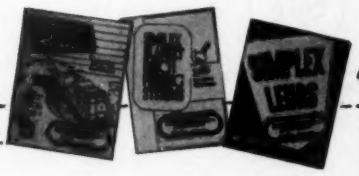

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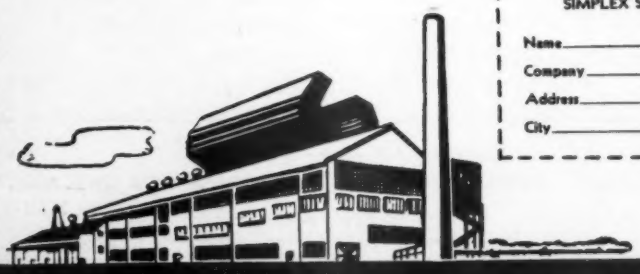


COMPLETE GLASS MANUFACTURING PLANTS
★ MODERN VENTILATED STEEL FACTORY BUILDINGS
DESIGNS . . . . . APPRAISALS

the glass industry
VOLUME 36, NUMBER 9, SEPTEMBER, 1955

Evaluation of Metal Defects in Plate Glass Manufacture

By HEYWOOD J. KNIGHTON
Ford Motor Company, Dearborn, Michigan

• THE FORD MOTOR COMPANY is in business to manufacture automobiles. As we all are aware, an automobile is the completed assembly of hundreds of individually manufactured products. A substantial portion of the final assembly in dollar value, visible area and headaches is composed of glass; glass which must pass rigid quality specifications before acceptance.

We in production sometimes rationalize and shout that the specifications are too strict, and that "People don't look at a windshield, they look through it." Actually, we may have a point. Nevertheless, the specifications continue to get tighter and perfection seems to be the ultimate.

Because of these specifications, a lot of glass which would appear "A" Grade to the casual observer ends up back in the furnace as cullet and is given a second chance to end up in somebody's automobile. Meanwhile, quite a bit of labor and overhead have gone down the drain.

I would like to look back at our last partially completed furnace campaign and discuss briefly the reasons why some of the 90-odd thousand tons of glass produced did not end up in someone's automobile—at least the first time around. In order that you may see the picture more clearly, I think that I should first describe the equipment and general operational characteristics involved.

Our batch consisted of the usual raw materials: sand, Hi calcium limestone, raw dolomite, soda ash, salt cake, charcoal, iron oxide and cullet. I might add that all of the cullet was our own variety.

Raw materials were received inside the building in closed bottom dumping cars. After chemical and sieve analyses were run by the control laboratory, these materials were unloaded through the floor and by means of a belt conveyor and bucket elevator discharged into concrete silos above the batch room. The weighed material (including half of the cullet used) traveled via belt conveyor to the mixers. The mixed batch was transported to hoppers located above the doghouse by a bucket conveyor and from there flowed by gravity into two screw-type batch stokers. The remaining 50% cullet used was fed into the system at this point. Batch piles were formed in the doghouse and were periodically pushed into the furnace by the furnace operator. The glass level was controlled by the rate of feed.

The glass melting furnace had five ports, was 22 feet wide, 117 feet long, and carried a depth of glass of 59 inches. A suspended curtain was located between the melting end and the machine. The molten glass flowed from the refining end through a 4″ notch in the top of the front end-wall blocks into a 52″ wide canal or spout and arrived at the rolling machine 44 inches later.

Our fuel was coke oven gas. Melting temperature control was accomplished by means of radiation and optical pyrometers. The furnace pressure was maintained constant with a slight positive pressure at the glass line. The "Hot Spot" was maintained at or slightly beyond No. 3 Port.

Now, to get back to the reasons why all of the glass made during the last campaign did not get into someone's automobile. The significant reasons due to poor glass quality, of "Metal Defects," may be classified in decreasing dollar scrap cost as follows: (1) cords or ream, (2) bubbles and seeds, (3) stones.

Our greatest metal quality headache, the one we have referred to as ream, caused more grey hair around the plant than all others combined. The standard glossary of terms defines ream as "Non-homogenous layers in flat glass." Text books and reference books list a multi-

Presented before the Fifteenth Conference on Glass Problems, Ohio State University, Columbus, Ohio.

tude of reasons for this defect and I sincerely believe all of them, due to its elusive and certain times baffling nature.

Assuming that we had taken all practical precautions in order to prevent this defect, then the ream story began with its detection at the end of the lehr. An hourly rated inspector cut a one-inch wide strip of glass across the ribbon at frequent intervals and examined it in a polariscope. The interval between each check was governed by the existing quality of the glass. For instance, if the general quality had been good, then a strip was cut every 30 minutes. If there had been evidence of ream, then the time between checks was decreased accordingly. We have found through experience that unless hetrogeneous layers show strong birefringence, they are not visible to the naked eye in the polished plate glass. Of course there are exceptions to this generalization as many of you have probably experienced.

If the presence of ream, either of the single or multiple variety, was detected, then the entire output from the furnace was scrapped until at least two subsequent checks failed to show the presence of the defect. We have found this procedure to be profitable due to the fact that all we lose by scrapping the rough plate is a minimum amount of labor and its fuel cost. If it were ground and polished and then scrapped, the dollar loss would be multiplied several times.

The question now arises, "What corrective action was taken when ream was detected in the ribbon?" First of all, if there had been some definite disturbance to the system within a reasonable time preceding the original appearance of the defect which may have explained its presence, then we did nothing and let nature take its course. However, usually there was nothing definite to explain the presence of the defect. From experience, we had classified ream into four types. The corrective action for each classification was as follows:

Type Number One: General quality of the glass has been good. Ream comes into one edge of the ribbon and persists. This type of ream was usually traced to a build-up of devitrification against the metal spout side casting immediately behind the rolling machine. The cure consisted of calling down the machine operator, applying localized heat to the suspect area, and pushing the glass adjacent to the side casting out into the main body of glass.

Type Number Two: General quality of glass has been good. Periodic appearance of a single ream for indefinite duration but always in the same area of the ribbon. Appearance of ream is occasionally associated with variation of glass temperature in spout. Age of spout is considerable. The ream was assumed to be caused by a worn refractory spout floor, or perhaps a crack in the spout floor. Immediate action was to decrease the spout glass temperature. If the ream disappeared, this was considered evidence to support the original assumption. The glass temperature was than raised. If the ream appeared, this was further evidence to support the assumption. If, after further investigation concerning the melting conditions, constancy of batch room operations, etc., the ream still persisted, the rolling machine with its attached flux transfer block was removed and examined. If the flux block was damaged or worn in the suspect area, then another machine was installed and production was resumed. If the transfer block was in good shape, then a new spout assembly and another rolling machine were installed. If the ream still persisted, then management started shopping around for a new ceramic engineer.

Type Number Three: Ream appears quite suddenly across a substantial portion of the ribbon. Melting conditions appear normal. The trouble was assumed to have originated in the batch room. All batching operations were immediately stopped. Scales were checked for accuracy. Raw materials were checked visually and solubility checks were run by the control laboratory for contamination. Discharge cycles, batch mixers, collecting belts, etc., were checked for malfunction. If no trouble was found in this area, we assumed that a "bad batch" had been made, which was already in the system, and therefore resumed batching operations. The role of the ceramic engineer then became that of the crystal-ball gazer, in assuring the plant manager that the trouble would clear up in so many hours and minutes.

Type Number Four: Intermittent ream either of single or multiple variety having no definite position in the ribbon accompanied by general cordiness of entire ribbon. This type of ream constituted our most serious scrap problem and caused more ulcers and grey hair than all other defects combined. When it occurred, corrective action was taken as follows: The spout glass temperature was increased and then decreased in an effort to change the characteristics of the ream. The batch handling system was gone over with a fine tooth comb. Batch mixer blades were changed, if they showed signs of conspicuous wear. Scale checks were doubled or tripled. If the salt cake was lumpy, then it was weighed by hand until the lumpiness disappeared. (I might add that more often than not lumpy salt cake and ream trouble were associated together.)

All batch materials were checked for contamination with each other. The batch room cullet which had a chance of being contaminated with cullet from purchased glass was cut off and we reverted to using the current scrap that we were manufacturing as our sole source of cullet. Furnace temperature levels and gradients were checked and adjusted if considered necessary. Tighter controls were exercised over metal line, rolling machine speed, batch cullet ratio, positioning of batch piles within the furnace, appearance and location of salt water, and rolling machine speed.

After the foregoing had been accomplished and if the trouble still persisted, then we really got worried. If, during this simultaneous activity on all fronts the trouble actually disappeared, I'm afraid that the real cause remained obscure. I firmly believe that quite often it was a combination of more than one small factor that caused us grief, for at times we experienced severe disturbances without the appearance of ream.

I would like to present now the case history of one serious epidemic of ream, which we experienced during the preceding campaign. The pertinent facts were as follows:

(1) The trouble started within one week after starting production on the rebuilt furnace and lasted four months.

(2) The ream was Type No. 4, in that it had no definite location in the ribbon; it would appear suddenly in beautiful homogeneous glass, last for several minutes and

then completely disappear, only to reappear a half hour or so later, for no apparent reason.

(3) The melting temperatures and production rates were similar to past successful performances.

(4) The identical batch and cullet supply was employed.

(5) We were operating without the usual refining end skim bar and, therefore, our refining end temperatures were approximately 100 degrees higher.

(6) On the previous campaign, we had operated for short intervals of time with identical high refining temperatures without the appearance of ream.

(7) The furnace refractories were essentially the same as on the previous campaign with the exception of the spout entrance block.

(8) Half of the flux spout assembly was changed during the epidemic without affecting the ream.

(9) Production was halted for one month during the steel strike of 1952 and holding heat was employed on the furnace. When production was resumed, the ream resumed right with it.

(10) Furnace operating personnel had testified that the ream could be changed to a different location by raking the glass in front of the spout entrance, thus substantiating the theory that it was originating in the melting end of the furnace.

Because of curtailed production due to the steel shortage at this time, the situation was not too serious; we tried all of our standard cures, including some which were nonstandard, but to no avail. The ream still persisted.

You have probably already guessed the real source of the trouble. It was originating from the new spout entrance block. The cure was simple—by cooling the glass adjacent to this block, the trouble cleared up within two hours and never reappeared. The irony of the situation was this: On the previous campaign, we were plagued with bubbles which originated from the identical location. The identical method which had minimized the bubbles cured the ream.

Less conspicuous in its occurrence, but a consistent scrap factor was the defect we refer to as "Bubbles." Our manufacturing specification pertaining to this defect reads as follows: "A single bubble not greater than $\frac{1}{16}$" in diameter or an occasional grouping of two bubbles not greater than $\frac{1}{32}$" in diameter is permissible. Seeds less than $\frac{1}{32}$" in diameter are inherent defects which are acceptable." Of the two forms of gaseous inclusions, our primary scrap loss was from bubbles. Unfortunately, in our glass plant we do not keep an absolute check on fine seed count, etc. We only keep records of actual scrap losses. Fortunately on the furnace campaign in question, we were never in serious difficulty due to bubbles or seeds. I shall therefore merely enumerate several definite assignable causes to flurries of this defect which we experienced:

(1) Upset melting conditions usually caused by one of the following reasons: (a) Conspicuous drop in temperature in melting end. (b) Severe change in batch-cullet ratio accompanied by a radical change in the amount and location of salt water pools in the furnace. (c) Radical change in temperature gradient in melting end.

(2) Radical lowering of glass depth in spout.

(3) Installation of new rolling machine or spout.

(4) Pieces of any foreign object, especially iron, falling into glass behind rolling machine.

(5) Reaction of glass with refractories in spout. Included in this category is the formation of bubbles around cracks or joints in the spout floor refractories. (I might add that we are currently enjoying this difficulty.)

These assignable causes were usually detected without too much difficulty and corrective action taken.

There are a few factors pertaining to the over-all picture of bubbles which I think should be mentioned before leaving the subject: (1) During the campaign, the ratio of salt cake to sand was varied from .053 to .071. (2) The cullet to sand ratio was varied from .65 to 1.5. The campaign average was .92. (3) The production rate was varied from 115 to 153 gross tons of glass per day. (4) The "Hot Spot" temperature never exceeded 2740°F. and was not increased proportionately to the production rate. (5) We did not use any fining agent as such in our batch. (6) We were forced to operate with a reducing atmosphere at No. 5 Port for the entire campaign. (7) The size and positioning of the batch piles within the furnace depended upon the initiative of the furnace operator. (8) The melting area of the furnace occupied 42.5% of the total furnace area.

Since the adoption of electrocast refractories for melting end sidewalls, our trouble from stones has been minimized, and on the preceding campaign rather clear-cut. Normally, all visible stones were cut out of the ribbon at the end of the lehr, but of course at times this procedure was impractical due to their preponderance. Stones usually fell into one of the following classes:

(1) A serious epidemic of stones after every major production interruption, such as a rolling machine or spout replacement, or a mechanical breakdown of the drive mechanism. These epidemics lasted approximately 8 days, the number of stones being a maximum upon resumption of production and diminishing to normal by the eighth day. This type of stone epidemic became more serious as the furnace became older. (2) A short flurry of stones following regular maintenance to the crown, port floors, etc. (3) Inclusions of iron originating from burners in the spout of scale falling into glass off cooler bars. (4) Batch scum originating from a dry tank. (5) Devitrification originating from localized cold areas adjacent to rolling machine. (6) Inherent stones in the process. We have found that the correct amount and location of salt water pools within the furnace cannot be overemphasized in minimizing this form of defect and a lot of other trouble.

Now that I have discussed the general occurrence and severity of the three principal metal defects, let us get a little more specific. If we represent the total dollar loss of polished plate glass due to these three types of defects as 100%, then the proportionate costs would be as follows: Ream 40%, Bubbles and Seeds 30%, and Stones 30%.

If we get even more specific, these same losses may be expressed as follows: One windshield lost per 650 square feet of ground and polished glass because of ream. One windshield lost per 900 square feet of ground and polished glass because of bubbles and seeds. One windshield lost per 900 square feet of ground and polished glass because of stones.

What do these figures mean? Certainly, in the production of a product wherein some of the raw materials have melting points exceeding 4600°F. and wherein cooling air

(*Continued on page 494*)

Segmental Loading Reduces Glass Damage

By HENRY E. WALKER

Harding Glass Company, Fort Smith, Arkansas

● "ALL MANUFACTURING, engineering and quality efforts are in vain if the product reaches its destination in a damaged condition." The aforesaid quotation, made by R. F. Bisbee, Westinghouse Electric Corp., in the general session of the American Ceramic Society in 1953, certainly makes sense to our company. Through the years, we have loaded, blocked and braced our product to the best of our know-how and ability, or we thought so at least. Still we would have complaints from time to time from unhappy customers who had received our product in a damaged condition. Opportunities for on-the-job studies of loads at destination were limited; therefore, after careful consideration of the problem with our general management, Engineering Department, Processing and Shipping Departments, it was decided to conduct a series of controlled tests, employing valuable loads of window glass blocked and braced ready for shipment to the customer.

We secured the cooperation of our servicing railroad, the "Frisco," in the venture and after incorporating their constructive thinking into the plan, set forth to simulate, in a few hours, the kind of rough handling that might be

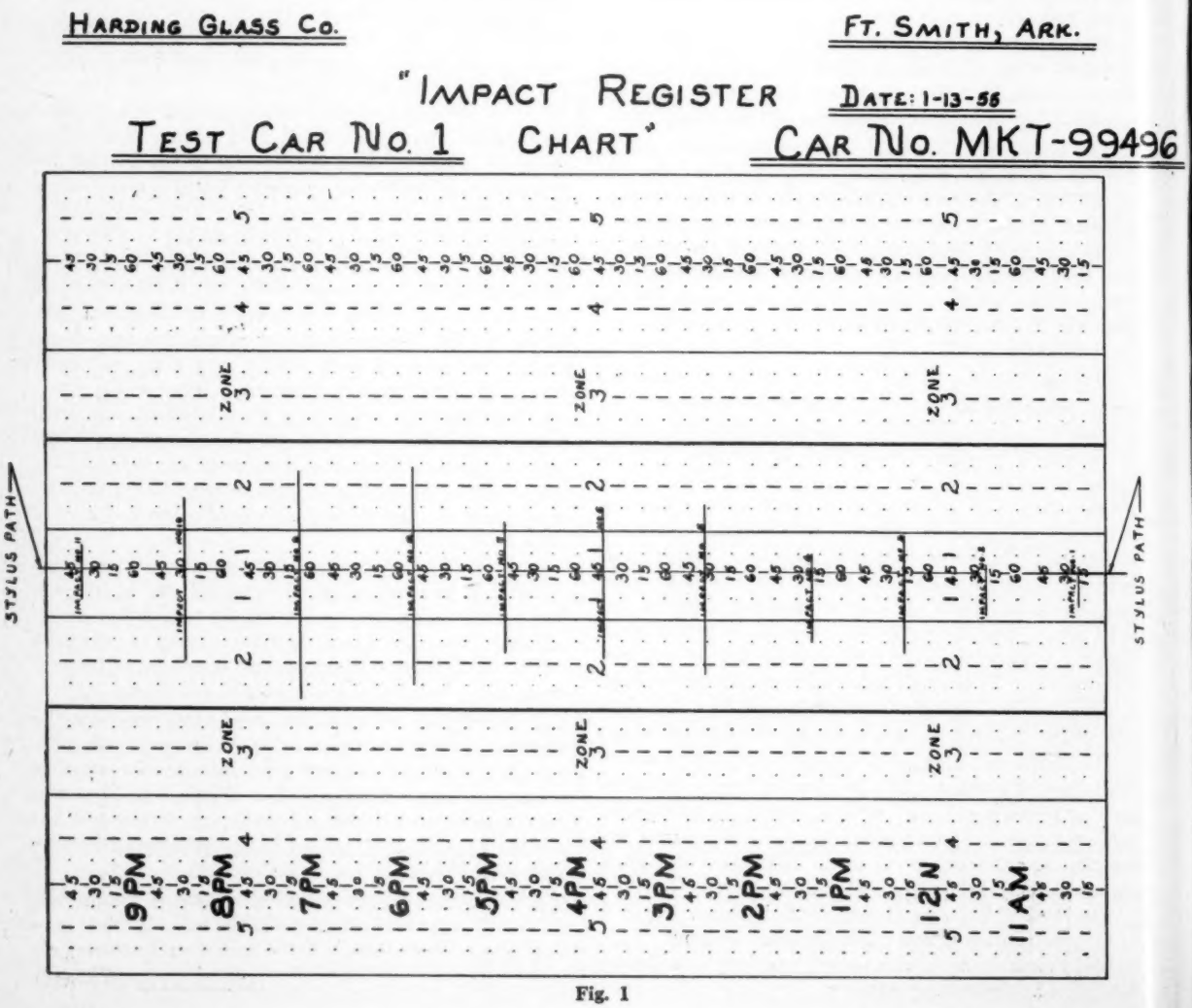


Fig. 1

expected over a long haul to determine to what extent we must go in packaging, loading, blocking and bracing our product to insure its safe arrival at destination.

Our first large scale testing of carloads of flat glass was conducted during April, 1953 and the findings were reported to the 14th Conference on Glass Problems at the University of Illinois in December, 1953 and the full text was published in THE GLASS INDUSTRY, April 1954 issue.

Three cars of glass were used in the first tests, each being a different type load. Test car No. 1 was loaded with standard pallets and standard fifty foot boxes of window glass. A rigid doorway floor block was used and it held very well. Test car No. 2 was loaded with standard fifty foot boxes of window glass and the doorway was blocked with a rigid floor block which failed during the test. The material used for blocking appeared to be at fault, rather than design of blocking. The material for blocking future shipments of this type was changed immediately. Test car No. 3 was loaded with standard fifty foot boxes of window glass and the entire floor of the car was covered. Enough slack developed in this load to indicate a need for compact loading. Other loading faults, such as improper step-down and care in matching members of the boxes so that impact thrust will carry through the boxes and protect the glass, were noted.

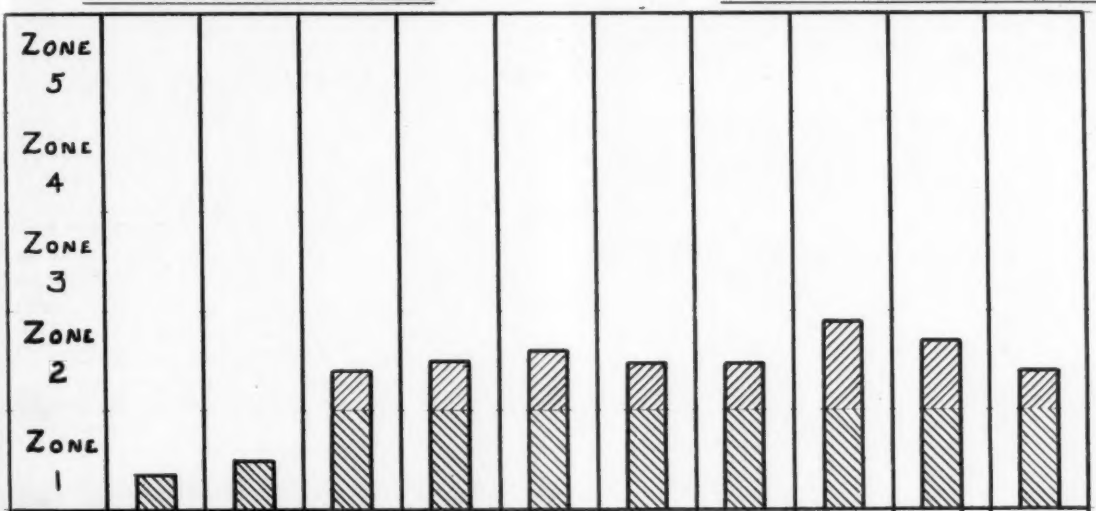
On December 1, 1953, another series of impact tests were conducted. One of them was on the same type load as the original No. 2 test car to see whether the faults in floor blocking had been corrected. This new blocking material and design proved itself with flying colors.

"How much impact will your load stand and still give you a satisfied customer at destination"?, is the question that has stimulated considerable research by our company on "safe load impacts" during the past three years. During a period of one year, we shipped 24 cars of window glass, in which we had installed an impact register (or bug) into 16 different states. These cars showed a total of 72 impacts registered above 5 m.p.h. and the impacts ranged up to 11 m.p.h. on two cars and all the others, except five, had 7 to 10 m.p.h. maximum impacts. This indicated to us that blocking and bracing must be considered to fortify the load against rougher than the car-

HARDING GLASS CO. FT. SMITH, ARK.

IMPACT TEST

TEST CAR NO. 1 CAR NO. MKT-99496



IMPACT No.	1	2	3	4	5	6	7	8	9	10
CAR SPEED M.P.H.	2	3.6	3.4	4.3	4.84	5.17	5.77	6.53	5.55	5.17
IMPACT AGAINST	EB - QCT	EB - CT	EB - CT	C -	C -	E - CT	E - CT	C - D	E - CT	C - D
SLACK B.E.	0	0	0	0	0	½	1"	0	1	0
SLACK O.E.	0	0	0	0	0	0	0"	¾	0	½
SLACK DOOR	0	0	0	½	5/8	0	½	½	½	½
BLOCKING & BRACING DAMAGE B.E.	~~0~~	0	0	0	0	STRAPS	STRAPS	STRAPS	STRAPS	STRAPS
BLOCKING & BRACING DAMAGE O.E.	0	0	0	0	0	LITTLE LOOSE	LOOSER	LOOSE BUT SAFE	LOOSE BUT SAFE	LOOSE BUT SAFE
BLOCKING & BRACING DAMAGE DOOR	0	0	0	0	0					
BOX DAMAGE B.E.	0	0	0	0	0	0	0	0	0	0
BOX DAMAGE O.E.	0	0	0	0	0	0	0	0	0	0
BOX DAMAGE DOOR	0	0	0	0	0	0	0	0	0	0

Fig. 2

riers prescribed normal rough handling borderline of 4 m.p.h.

Three common causes of damage are acceleration, impact and fatigue. It has been said that "the predominant damage force causing breakage of glass in rail shipment is the horizontal impact force directed lengthwise through the car." The majority of our research and testing has been on horizontal impacts.

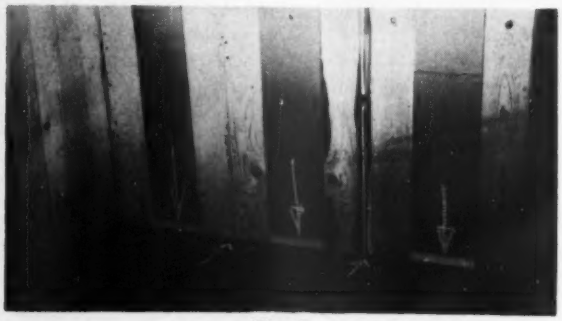


Fig. 3

Fig. 4

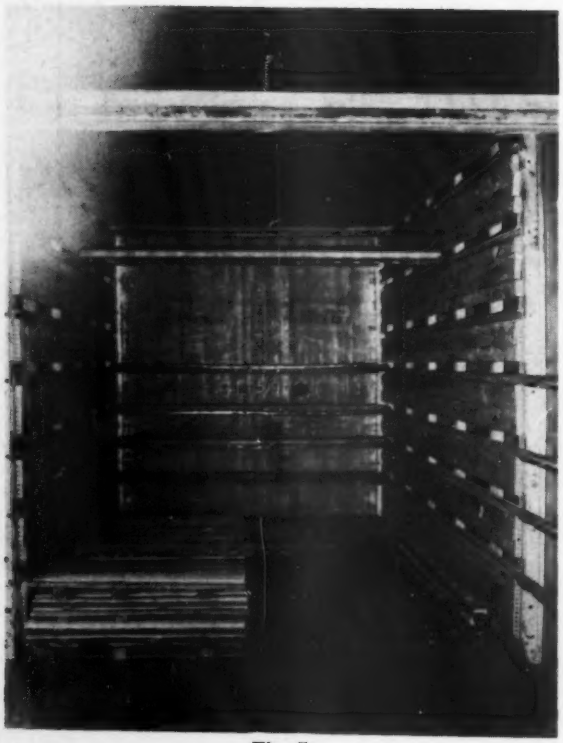


Fig. 5

You have heard it said that, "it isn't the fall but the sudden stop that hurts." The impact register chart in Fig. 1 indicates that the same is true of load impacts. In the path of the stylus may be seen lines at right angles labeled impact No. 1, No. 2, etc. The length of this line from the path of the stylus or zero point indicates the shock received by the impact recorder, in its fixed position, on the floor or the wall of the car, or truck, when bumped by or into something; or upon fast acceleration or deceleration. As an impact occurs, the commodity in the car proceeds toward the impact or sets still and the floor slides under the load. If the load could continue sliding free until it lost its momentum, then very little damage would result. However, the end of the car or the blocking stops it suddenly and damage may result.

The bar chart in Fig. 2 shows some results of one of our latest tests of a car loaded with flat glass. The bars show the impact zone reached on each impact. The other data at the bottom shows car speeds in m.p.h., along with results of damage to blocking, bracing, strapping and boxes.

The following ten observations were listed in our earlier report. I would like to enlarge upon about three of them; then report on some "impact tests" of a car loaded in segments, with each segment steel strapped against impact in one direction. This has proven to be one of the best methods of loading and blocking we have found to insure safe arrival of our product. (1) An impact recorder is a very valuable instrument in helping determine the cause and to control damage from impact, and its use helps promote the good will of the customer. (2) Use of the impact recorder enables us to assist the carrier in promoting safe arrivals. (3) Costs of blocking and bracing are pinpointed and weighed. (4) Zoning of damages by sections or destinations permits special precautions with shipments going to certain areas of the country. (5) The relationship of one unit or package to the other regarding transfer of load or pressure through the unit or package at the strongest point is important in preventing crushing and other forms of damage. (6) Multiple layers in the load are often responsible for damage when each successive layer is not properly blocked or anchored. (7) Loading, bracing and blocking a carload in segments reduces damage. (8) One heavy impact 5 to 10 m.p.h. does more apparent damage to blocking and bracing than several light impacts 2 to 4 m.p.h. When damage occurs the load has generally had heavy impacts. (9) We have determined the impact against which we think we must fortify our load. This is

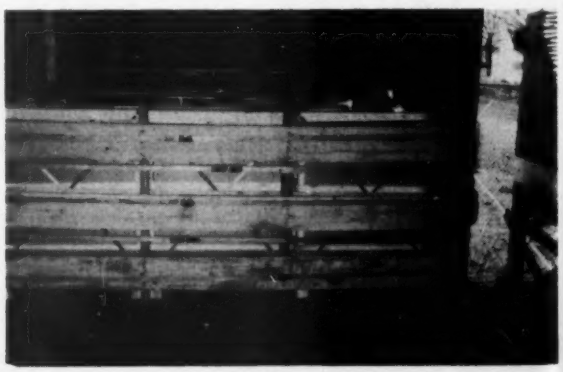


Fig. 6

subject to change with further research and experience. (10) Data on loading, blocking and bracing window glass seems to be very scarce.

Looking to the above-mentioned observations, Nos. 5, 6 and 7 in particular, and considering No. 5 first, we find that in loading a car of glass, more than ordinary care must be exercised in matching one box or crate against the other so that a stiff portion of the box will butt firmly against the box on either side of it, in line with the length of the car, similar to the picture in Fig. 3, where the ¾" ends of the box are joined at the floor line. This takes all of the thrust from impact of the boxes on either end and protects the glass. With a 30 or 40 ton load thrusting against the end box, damage such as that shown in Fig. 4 may result, or even splinter the stiff member of the box. In this case, the bad end of the railroad car contributed. Observation No. 6 is one that is hard to control in some loads and one of the best answers may be found in observation number 7, where segmental loading may reduce the load that can be thrust against any single box or crate to a safe point. One type package that profits considerably from this type loading is the pallet. We have shipped many such loads with safe arrival during the past few years, both as a steel strapped segment load and in "D.F. Loader" cars, and of the many "D.F." cars of standard pallets we have shipped, there has been no damage reported to date. The "D.F. Loader" embodies the ultimate in flexibility and utility for segmental loading. However, when this type car (see Fig. 5) is not available, we use

(*Continued on page* 490)

Fig. 7

Fig. 8

Fig. 9

Fig. 10

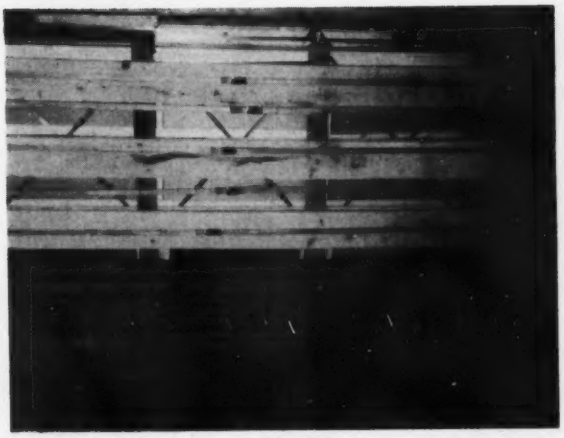


Fig. 11

Nickel-Base Alloy Insert Increases Thimble Life

• THIMBLES USED by the glass industry in making bottles are subject to a great deal of wear as a result of extreme conditions of heat and abrasion. Cast iron thimbles having wearing surfaces protected by a special nickel-base alloy insert are lasting five times as long (average) as plain cast iron, according to a recent report released by Overmyer Mould Company, Inc., Winchester, Indiana.

The inserts are similar to that shown in Fig. 1 which is cast of Colmonoy No. 4, a special alloy having exceptional abrasion and corrosion-resistant properties as well as excellent red hardness.

Production Procedure

In preparing the thimble to accept the insert, it is bored .005 in. greater than the outside diameter of the finished Colmonoy insert (Fig. 2) to allow space for silver solder

Fig. 1. Insert used by Overmyer Mould Company to extend life of thimbles. Units protected with this Colmonoy No. 4 nickel-base casting last five times as long as unprotected thimbles.

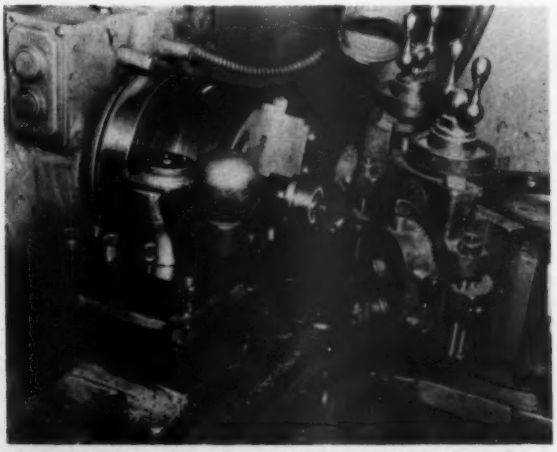


Fig. 2. Thimble boring operation on #4 Gisholt. Thimble is bored .005 in. larger than OD of finished Colmonoy insert.

Fig. 3. Sweating thimble and insert by heating with acetylene torch flame. Parts are rotated while heat is applied for uniform silver solder bond.

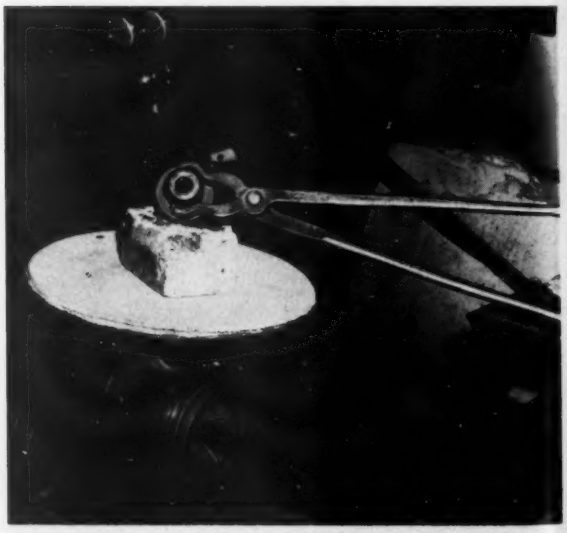


Fig. 4. Thimble and insert assembly following the sweating operation.

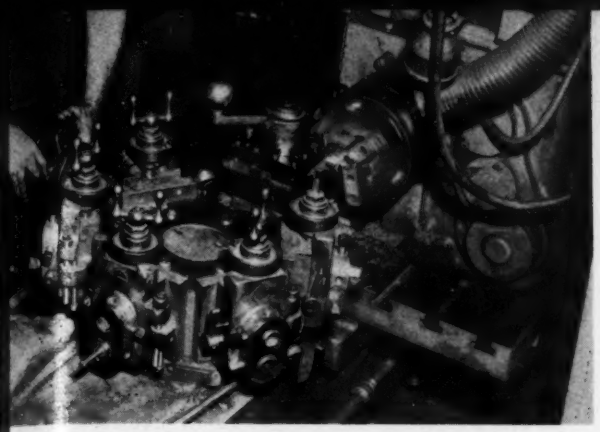


Fig. 5. Machining insert face of protected thimble on #4 Gisholt. Machining is accomplished with #883 carbide tip tool using .005 in. feed at 235 rpm.

in the sweating operation to follow. Insert and thimble are next thoroughly cleaned by sandblasting. Silver solder wire is placed in the thimble recess, both pieces are fluxed and the insert is placed in the prepared thimble opening.

Bonding action occurs when thimble and insert are brought to high heat by application of an acetylene torch flame (Fig. 3). Uniform heating is achieved by rotating the assembly during this operation. Fused assembly following sweating operation is shown in Fig. 4. Thimble-insert assembly is next faced to length and the insert ID bored to finished dimension concentric with thimble OD. Machining of this hard material is accomplished (Fig. 5) with a tungsten carbide tip tool.

The mating plungers are given a protective coating of Colmonoy No. 4 applied in powder form by the Spray-weld process (Fig. 6). The clean-up machining operation which follows (Fig. 7) leaves an ideal thickness of .020 in. on the hard-faced plunger surface.

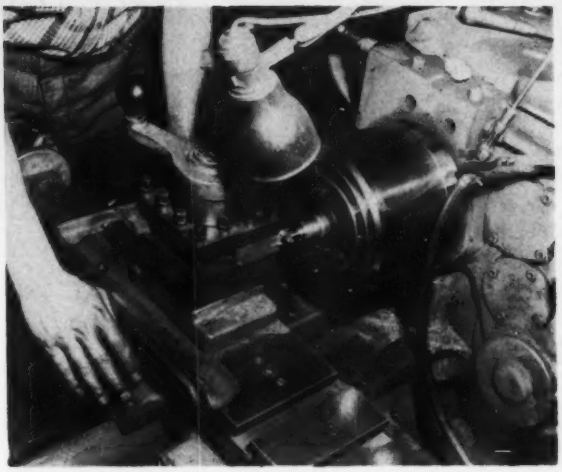


Fig. 7. Machining plunger OD following Spraywelding. This operation leaves an ideal overlay of .040 in. on the diameter.

The protected plunger and thimble shown in Fig. 8 are used on a Hartford 8-section machine in the production of a small grape juice bottle.

Properties of the Protective Surfaces

The Colmonoy No. 4 which enables thimble and plunger units to outlast 5 units of conventional construction is a non-magnetic nickel-chromium-boron alloy. It has good abrasion, impact and galling resistance and excellent corrosion resistance, red hardness and weldability. The alloy has a specific gravity of 8.22 and melts at 2025°F.

Fig. 6. Plunger being Spraywelded with Colmonoy No. 4 in powder form. Plunger is protected by using the same material as that from which the thimble insert is cast.

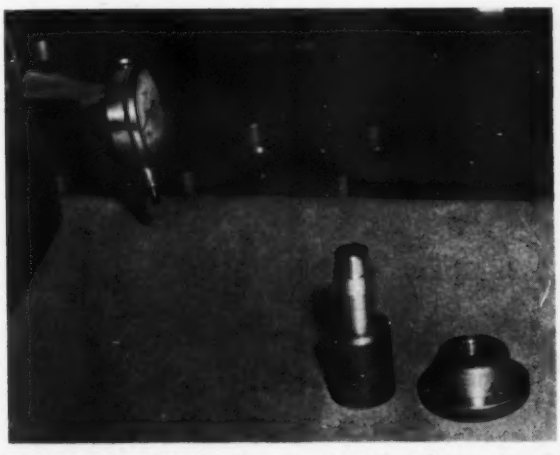


Fig. 8. Plunger and thimble protected with Colmonoy No. 4. This unit is used on a Hartford 8-section machine to produce a small grape juice bottle, a flint glass seamless top container.

NEW PLANT HAZEL-ATLAS IN ILLINOIS

J. H. McNash, President of Hazel-Atlas Glass Company, announced that the Board of Directors has authorized the construction of a glass container plant in the Chicago, Illinois, area. The new plant will be erected on the 75-acre tract of land now owned by the company, located on the outskirts of the town of Plainfield, Illinois.

Construction of the plant will begin immediately.

CHAS. TAYLOR SONS PLANS EXPANSION

The Chas. Taylor Sons Company, a subsidiary of National Lead Company, has announced plans for a major expansion and improvement of its Taylor, Kentucky plant. The firm manufactures special refractories, mainly for the glass and metallurgical industries. Production capacity of the plant will be increased about 35% by the installation of new equipment.

Recent Translations of Russian Papers of Interest to the Glass Industry

Movement of Molten Glass in Molds

The movement of glass mass in molds of relatively complicated design has been described by Yu. A. Gastev and E. G. Frolova in *Steklo i Keramika* (*Glass and Ceramics*) **10,** No. 6, p. 8 (1953). They used the method of incomplete pressing, i.e., the inward motion of the plunger was stopped in different positions, and the shape of the "monsters" thus obtained was analyzed.

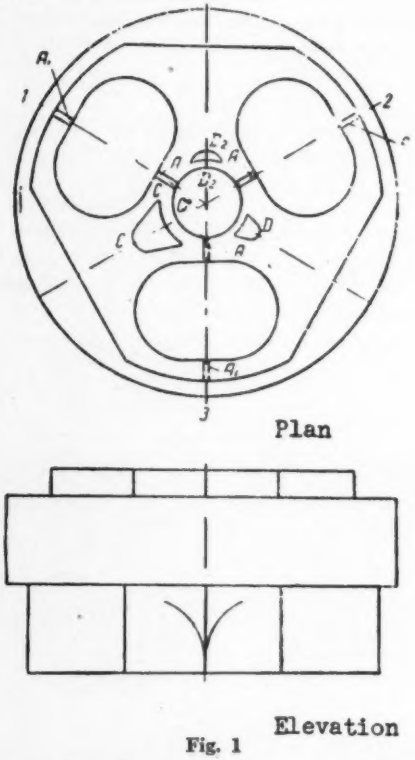


Fig. 1

Two manufacturing processes were examined. In the first, vessels shown in Fig. 1 were pressure molded. They contain four hollows shown on the plan in the upper half of the figure. This figure illustrates also the two main defects which often appeared in the finished product. The lines marked A and A_1 are the "seams" which were visible in all vessels and often functioned as the origin of cracks. The three bubbles marked C, D′, and D_2 happened less frequently.

Fig. 2 gives a better idea of the structure of the "seams." It is seen that each "seam" A (between the central and a peripheral hollow) is a vertical plane, while each "seam" A_1 consists of two curved surfaces coming together near the top of the vessel.

Fig. 3 makes the genesis of the "seams" of the A_1 type clear. The glass melt first moves in two opposite horizontal directions; thus elevation *b* is obtained from elevation *a*. Later, the melt covering the bottom of the mold starts rising, and the vertical cross-section perpendicular to the future "seam" looks, consecutively, like *c*, *d*, *e*, and *f*. Thus, A_1 is the result of collision of two horizontal and one upward stream. On the other hand, A is formed by meeting of two horizontal streams only.

The metal projections on the plunger (corresponding to the four hollows in the finished vessel) retard the flow of glass melt near the metal-liquid interface. This causes the particular position of the bubbles, as illustrated in Fig. 4, which is a vertical cross-section through bubble C of Fig. 1. The bubble is indicated by letter *a*. It started at *c* and its way from *c* to *a* is visible as a "milky way" of very small bubbles. Although the bubble started in contact with the metal pin, it finally became separated from the metal-glass interface by a considerable layer of glass. This shows that the rate of rise of the melt was greater further from the interface, than at the interface.

The second process studied by Gastev and Frolova was the pressing of T tubes as illustrated in Fig. 5. Before the plunger starts its downward movement, the bottom of the mold is covered with molten glass almost to the lowest point of the side tubulus (E on the photograph), and the thick pin (around which the side tubulus will form) is fully inside the mold. In the initial experiments, when the

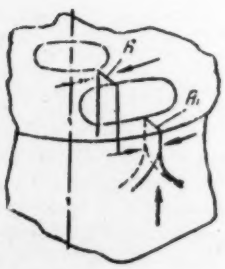


Fig. 2

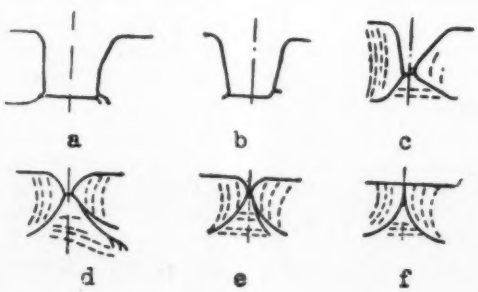


Fig. 3

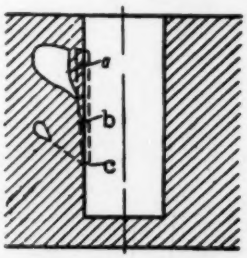


Fig. 4

Fig. 5

pin was in this position, a clearance of 0.7 mm. remained between the front surface of the pin and the cylindrical surface of the plunger.

When the plunger starts moving down, the liquid flows first toward point A and, at a smaller rate, up toward point C. The upper part of the tubulus is formed by coalescence of two streams rising, respectively, along the nearer and the further (from the observer) side of the pin. Near point D the two streams are still hot and fuse together without giving rise to a "seam." Also, in point F they are still hot because the glass moves relatively rapidly in the thick flange. However, between D and F the streams may be so cool that they do not fuse together, and a "seam" forms. The parts adjacent to B obtain their glass from D, and the glass is relatively cool. The clearance between the plunger and the pin is filled by glass not, as would be expected, from below but rather from above and the sides.

Many cracks occurred because the tubulus near A was already cool when region B was still unfilled. To shorten the time interval between the arrival of glass at A and at B, the above clearance was made 2.5 mm. wide. Then, the melt moved up in the clearance, point B was reached sooner, and the frequency of cracks diminished.

The Photoelastic Constant of Glasses

An experimental study of the photoelasticity of glasses has been reported by G. M. Bartenev and V. I. Rozanova in *Steklo i Keramika* (*Glass and Ceramics*) **10**, No. 6, p. 13 (1953).

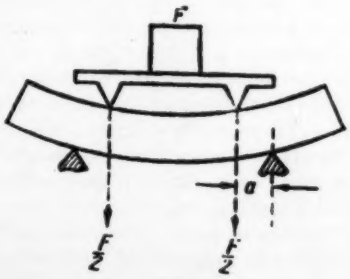


Fig. 1

The apparatus is schematically shown in Fig. 1. A bar of glass, b cm. wide and d cm. thick, is supported on two edges (dark triangles in the figures) whose mutual distance is l cm. and bent by a load F which acts on the glass bar along two lines between which the distance is $l\text{-}2a$; thus, the horizontal distance between a supporting edge and the nearer load line is a.

The compressive stress along the upper surface of the glass bar is $$\sigma = \frac{3\,Fa}{bd^2}.$$

It causes an optical path difference of Δ cm. along each cm. of the light path. The photoelastic constant B is defined as

$$B = \frac{\Delta}{\sigma}$$

From the above equation, it is $B = \frac{bd^2\Delta}{3\,Fa}$. Now, $b\Delta$ is the optical path difference when light traverses the whole width of the bar; $b\Delta$ is the value which is directly measured by the compensator. Let R be this value. Then, $B = \frac{d^2R}{3\,Fa}$, if R is expressed in cm.

The glasses used were tested either without a pretreatment or, after pickling, in dilute hydrofluoric acid. The pickled samples withstood compressive stresses up to 2000 kg. wt./cm² (i.e. 1962 bars or 28450 psi); thus, larger σ and Δ were accessible to the measurement than was possible with untreated samples (which ruptured at 600 kg. wt./cm²). The samples had d of 5 or 8 mm. and b of 4 or 6 mm., l was 100 mm. and a was 35 mm.

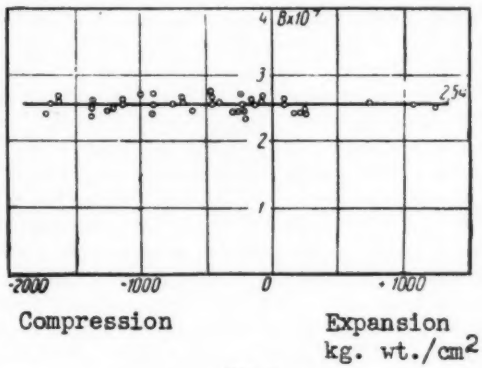


Fig. 2

Fig. 2 shows the results obtained on a glass containing SiO_2 71.3, Na_2O 15.9, CaO 7.6, MgO 3.3, and R_2O_3 0.7%. Stresses are plotted along the abscissa; expansion is right, and compression is left of the zero point. The unit is kg. wt./cm². The ordinate represents 10^7B in cm²/kg. wt. It is seen that B, in this case, is 2.54×10^{-7} cm²/kg. wt. (equal to 2.59×10^{-7} bar^{-1}).

Two important conclusions can be drawn from Fig. 2:

(1) The photoelastic constant is independent of the intensity stress.

(2) The photoelastic constant is independent of the sign of stress.

Analogous measurements were carried out on two other glasses. A glass containing SiO_2 72.3, Na_2O 14.2, CaO 10.9, MgO 0.9, and R_2O_3 1.1% had $B = 2.53 \times 10^{-7}$ cm²/kg. wt. A glass containing SiO_2 70.9, Na_2O 16.1, K_2O 0.6, CaO 8.1, MgO 2.9, and R_2O_3 0.9 had $B = 2.50 \times 10^{-7}$ cm²/kg. wt.

Strength of Glass Fibers

G. M. Bartenev and A. N. Bovkunenko, in *Zhurnal Fizicheskoi Khimii* (*J. Physical Chemistry*) **29,** 508 (1955), report their experiments designed to find the cause of the enhanced strength of thin glass filaments.

The authors consider three theories of this strength. According to the oldest one, thin filaments are strong because the molecules in their surfaces have been oriented by stretching. The statistical theory attributes this strength to the smaller probability of a bad flow in thinner specimen. The third theory assumes that stretching orients flaws in the whole extent of the filament.

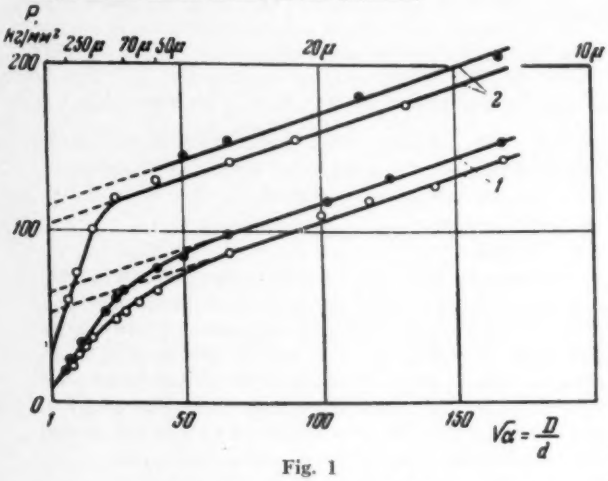


Fig. 1

Bartenev and Bovkunenko drew out glass fibers from an orifice 2 mm. in diameter. (The apparatus used is not indicated in the original paper.) The diameter of the fibers was varied between about 1 mm. and about 0.012 mm. The breaking stress of the fibers was plotted as a function of the ratio D/d, D being the diameter of the orifice (i.e., 2 mm.) and d the fiber diameter. Curves 1 in Fig. 1, which presents this plot, show that the breaking stress P (along the ordinate) rapidly increases with the ratio D/d (along the abscissa) at small values of D/d, i.e., as long as the fibers are relatively thick, while the increase at large values of D/d, is less rapid and practically linear. The upper of the two curves marked 1 (solid circles) refers to fibers drawn out at 1240°C., while fibers made at 1180°C. were used for the experiments summarized in the lower curve (open circles). The temperature of the experiments was 20°C. and the rate of loading: 0.25 kg. wt./min.

Filaments of different diameters were treated with hydrofluoric acid for different lengths of time. Thus, the diameters of the filaments were reduced to different extents. Then the breaking strength of these filaments was

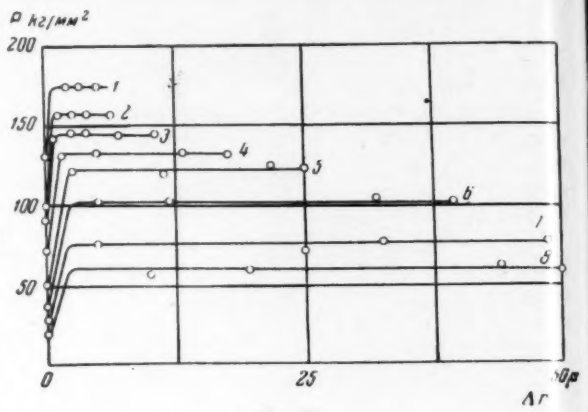


Fig. 2

determined. Fig. 2 shows the results. Its abscissa is the diminution of the radius; i.e., the thickness of the layer dissolved away by hydrofluoric acid and its ordinate represents the breaking stress P. Curves 1 to 8 show data obtained on fibers originally of 15, 22, 30, 50, 80, 120, 180 and 250 μ, respectively, 1 μ being 0.001 mm. or 0.00004 inch. It is seen that etching raises P by about 50 kg.-wt./sq. mm. and that, after a thin surface layer has been removed, further decrease of diameter has no effect on P.

The P values for etched filaments are plotted in Fig. 1 as curves marked 2. Again, the upper curve refers to fibers produced at 1240°C. and the lower, to fibers drawn out at 1180°C. It is seen that also for etched fibers, P is a linear function of D/d at D/d values greater than 50, i.e., for fiber diameters less than 50 μ.

The tensile strength shown in curves 1, Fig. 1, may be termed *surface strength*, while curves 2 denote *volume strength*. The independence of the volume strength of the fiber diameter, as demonstrated in Fig. 2, proves that the statistical theory of the strength is incorrect. Since the curves of P versus D/d consist of two branches each, the effect of stretching is twofold. At small degrees of stretching (i.e. D/d less than 50), the flaws present in the filament are oriented, while further stretching causes orientation of chemical bonds.

COVER PICTURE

The cover picture from the National Institutes of Health, in Bethesda, Maryland, graphically illustrates a use of glass apparatus.

The Institutes—there are seven of them devoted to finding ways to prevent or cure our major diseases—are the principal research arm of the U. S. Public Health Service. In the news recently, along with the Salk vaccine, the National Institutes of Health may well hold the answer to victory against heart disease, cancer and many of the other age-old enemies of man. The glass industry is a valuable ally here as it also helps scientific progress in many other institutions and many other fields of research.

E. S. HAGERTHEY OF WHEATON RETIRES

Edward S. Hagerthey, who has been actively engaged in the manufacture and marketing of glass containers for half a century, has announced his retirement effective at the end of July.

Mr. Hagerthey has been manager of the New York sales office of the T. C. Wheaton Company since 1918.

A resident of Roselle, New Jersey, for the past 35 years, Mr. Hagerthey has held most of the public offices in the borough including that of Mayor. He was also director of Civil Defense and Disaster Control.

Mr. Hagerthey is a member of the American Standards Association and an ex-chairman of the Tariff Committee of the Glass Container Association.

Inventions and Inventors

Feeding and Forming

Apparatus for Forming Cavities in the Wall of a Socket of a Pin-Type Glass Insulator. Fig. 1. Patent No. 2,710,492. Filed October 27, 1952. Issued June 14, 1955. Four sheets of drawings. Assigned to Pilkington Brothers Limited by John E. Wilcock.

This invention relates to apparatus for forming cavities in the wall of a socket of a pin-type glass insulator while the glass body is in a hot plastic state. In operation, the structure on which the tong members are pivoted is manually superimposed to a lower mold part 2, as illustrated in Fig. 1. When the structure has been superimposed on the mold part 2, pressure is applied to the knob 23 to move the rod 19 axially relative to the tong members so that the abutment 18 is moved into the gap 24. On the entry of the abutment 18 into the gap, the springs 16 swing the tong members about their pivot 13 so that the lower ends move apart and against the wall of the sockets 12, as indicated in dotted lines 10a, so that cavities are formed in the wall. When pressure is relieved from the knob 23, the spring 22 returns the rod 19 so that the abutment 18 is again located in its normal position between the upper ends 17 of the tong members 9 and, accordingly, the lower ends are again moved towards each other so that the structure can be removed from cooperation with the mold part 2.

The patent contains six claims and the following references were cited: 306,146, Gray, Oct. 7, 1884; 668,928, Parsons, Feb. 26, 1901; 1,502,561, Glaspey, July 22, 1924; and 101,527, Germany, Feb. 9, 1899.

Furnaces

Manufacture of Glass. Patent No. 2,710,306. Filed September 3, 1954. Issued June 7, 1955. One sheet of drawings (none reproduced). Harvey L. Penberthy.

In the operation of a conventional glass furnace, the batch charger mechanism intermittently-contacts the batch charge and is more or less always covered with a coating of soda ash dust. It has been found that this contact of the batch charger mechanism with the batch and this coating of soda ash dust and contact of the batch charger mechanism with this dust produces a partial ground at the charging end of the tank. Since the shears are normally and as a practical matter grounded, a stray current is caused to flow from one or more electrodes through the throat in the bridgewall into the working zone and thence through the glass outlet apertures to the shears, destroying the shears by arcing during each time the shears make and break contact with the glass. These currents are eliminated by providing one or more grounded electrodes either in the working zone, or in the fining zone in such a position as to prevent the flow of such currents through the throat of the bridgewall. This causes the stray currents resulting from partial grounding of the charging end of the tank to flow from the electrodes nearest the working zone to the ground electrode rather than through the outlet apertures to the shears, and enables a channeling of the currents in such a manner as to permit accurate thermocouple readings.

The patent contains 11 claims and the following references were cited: 2,545,619, Lambert, Mar. 20, 1951; 2,636,913, Lambert, Apr. 28, 1953; and 597,842, Great Britain, Feb. 4, 1948.

Glass Compositions

Chuck for Molten Glass Stirring Implement or the Like. Patent No. 2,707,640. Filed August 24, 1953. Issued May 3, 1955. One sheet of drawings (none reproduced). Assigned to Emhart Manufacturing Company by Arthur J. Dahms.

This invention relates to improvements in chucks for engaging the upper ends of vertical molten glass stirring implements, or the like, so as to suspend such implements so that they depend into places of high temperature, as into a body or stream of molten glass in a glass feeder forehearth or like place. A chuck is provided which has separable clamping jaws and associate locking rings and means for releasing these jaws without the use of screw-threaded fastenings. The novel method employed avoids the hazard of seizure or jamming that may occur when the conventional screw clamp was subject to high tem-

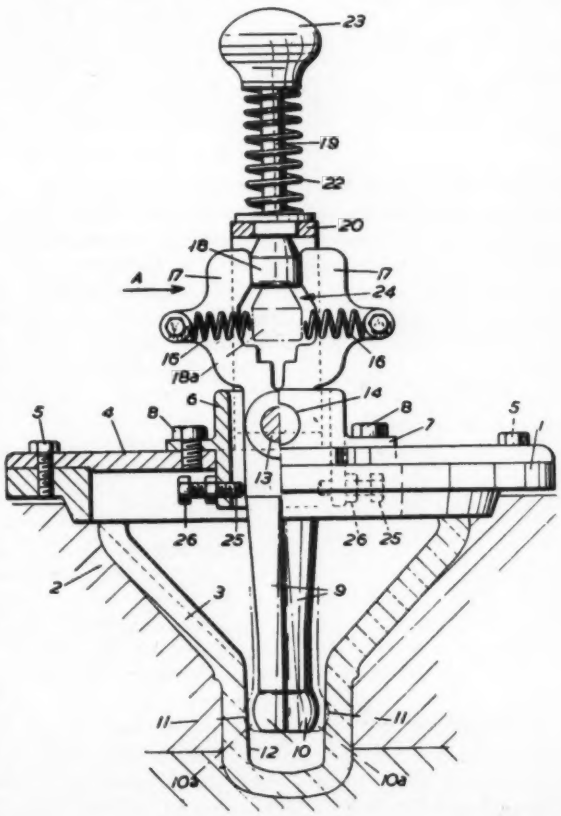


Fig. 1

perature and corrosion.

The patent contains six claims and the following references were cited: Re. 3,005, Stackpole, June 23, 1868; 718,306, Boring, Jan. 13, 1903; 730,311, Stewart, June 9, 1903; 760,598, Wynegar, May 24, 1904; and 609,908, Juenge, Jan. 19, 1909.

Method of Stain Marking Articles Having Vitreous Surfaces. Patent No. 2,707,688. Filed November 3, 1951. Issued May 3, 1955. No drawings. Seymour N. Blackman.

It is an object of the present invention to provide a method in which articles are stain-marked but are not heated in their entirety to the high temperatures characterestic of the staining process. An example of a heating decomposable metallic compound, which is useful, is the metallic halide, silver chloride. When a composition including this compound is heated in the vicinity of glass, upon decomposition of the compound the silver is liberated in a nascent state which is characterized by its ability to penetrate an adjacent vitreous surface in its immediate vicinity and to form a stain therein duplicating in pattern the pattern in which the composition was arranged. As is well known, the frequency of the machine is adjusted to approximately the critical (resonant) frequency for silver chloride. Thereupon, the application of a high frequency electrostatic field with extreme rapidity will elevate the temperature of the silver halide until the same decomposes and liberates nascent silver. The portion of the glass article heated is thus limited to that portion only which is decorated or stained. The process is especially advantageous in the decoration of filled thermometers.

The patent contains eighteen claims and the following references were cited: 1,217,490, Northwood, Feb. 27, 1917; 1,405,231, Krigel, Jan. 31, 1922; 2,405,249, Wilson, Aug. 6, 1946; 2,444,259, Jordan, Jan. 29, 1948 and Wein: "Metallizing Non-Conductors", 1915, pub. by Metal Ind. Pub. Co., N. Y. (pages 52 and 53).

Glass Wool and Fiber

Apparatus for Forming Glass Strands. Fig. 2. Patent No. 2,711,054. Filed August 14, 1951. Issued June 21, 1955. One sheet of drawings. Lebro T. Urbanetti.

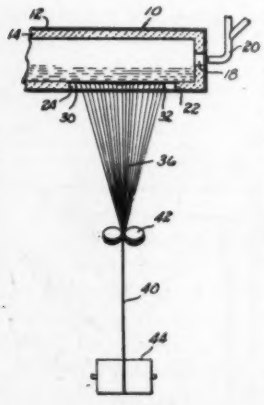


Fig. 2

It is a feature of the present invention to provide an improved method of fabricating glass strands which includes drawing or attenuating glass filaments from the furnace laterally as well as downwardly so as to avoid falling beads or droplets of glass. The drawing or attenuating plate 30, Fig. 2 is formed of heat-resisting material, preferably nickel-chrome alloys. The attenuating plate 30 is provided with a plurality of downwardly directed nipples 32, which are perfectly arranged in parallel rows, the nipples 32 in each row being staggered in relation to the nipples 32 in the adjacent row. It has been found that in most installations an included angle of 45 degrees between the axis of the orifices and the vertical results in the best arrangement. Filaments 36 may be drawn or pulled from the exposed portion through the orifices 34 (not shown) and in substantial alignment with the axis thereof. The filaments 36 are then collected or gathered into a strand 40 by directing the plurality of filaments 36 through a conventional gathering device 42 in the nature of a pair of opposed pulleys. The strand 40 is then secured to and wound upon a drum or spool 44 which is rotatably mounted below and laterally of the furnace 10. The drum or spool 44 may be power driven and will provide the tensioning force in the strand 40 to draw or attenuate the fibers 36 from the furnace. The size of the filaments and strands can be varied according to conventional practice, i.e., by varying the rate of attenuation, the size of the orifice openings and the heat of the batch. It has been found that in utilizing this method filament breakage rarely occurs. Consequently, the strand formed by the collected filaments is of uniform weight and thickness.

The patent contains one claim and the following references were cited: 2,255,426, Lamesch, Sept. 9, 1941; 2,448,499, Swann, Aug. 31, 1948; 449,233, Germany, Sept. 7, 1927; 740,049, France, Jan. 20, 1933; 823,535, France, Jan. 21, 1938; and 692,753, Germany, June 26, 1940.

Method of Bulking Glass Fiber Strands. Fig. 3. Patent No. 2,710,275. Filed May 1, 1951. Issued June 7, 1955. One sheet of drawings. Assigned to Owens-Corning Fiberglas Corporation by Jack H. Waggoner.

When the glass fibers work against each other, one glass fiber very quickly abrades another glass fiber and if the fibers are repeatedly worked against each other, a broken strand will develop which may lead to a hole in the fabric. The principal object of this invention is to provide a method for protecting the glass fibers from each other by cushioning each from its neighbors so that the abrasive effect of glass against glass is sharply reduced. Glass fibers 12 to be treated, as shown in Fig. 3, are led over a roller 13 and then through an orifice 14 in a guide 15 which is so located as to bring the fibers together in the form of a grouped strand 16. The strand 16 is then led over a pair of curved leaders 17 on a rotating traversing unit 18 and thence onto a rotating spool 19 mounted on a spindle 20. The traversing unit 18 serves to feed the strand 16 back and forth across the surface of the rotary spool 19 to lay up the turns of strands at sharp angle to previously laid up turns of strand. The roller 13 is peripherally engaged with a transfer roller 21 which is mounted to dip its surface into a pool of bulking and cushioning slurry contained in a tank 23. It has been found that if cellulose fibers, for example, are beaten very thoroughly and ground up to very fine sizes, they can be dispersed through a liquid carrier, for example water, as a very fine suspension and will remain in a uniformly suspended condition for long periods of time. The liquid material may be a water solution of starch or it may be a solution of a water-soluble resin such as hydroxy methyl cellulose. It may also be desirable for some of the fibers used to employ solutions of bone glue or wax emulsions or in other cases the slurry may be formed of a carrier consisting of latex. The purpose of the liquid carrier is to carry the particulate fibers forming the slurry onto the individual continuous glass fibers and then to adhere the particulate fibers to the glass fibers.

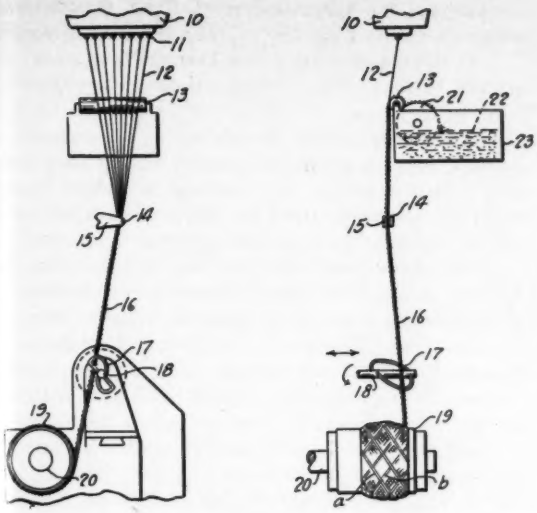


Fig. 3

The patent contains nine claims and the following references were cited: 2,234,986, Slayter et al., Mar. 18, 1941; 2,392,805, Biefeld, Jan. 15, 1946; 2,428,654, Collins, Oct. 7, 1947; and 2,531,571, Hyde, Nov. 28, 1950.

Method and Apparatus for Applying Liquid Materials to Fibers. Fig. 4. Patent No. 2,707,690. Filed April 10, 1951. Issued May 3, 1955. Two sheets of drawings. Assigned to Owens-Corning Fiberglas Corporation by Arthur J. Pearson.

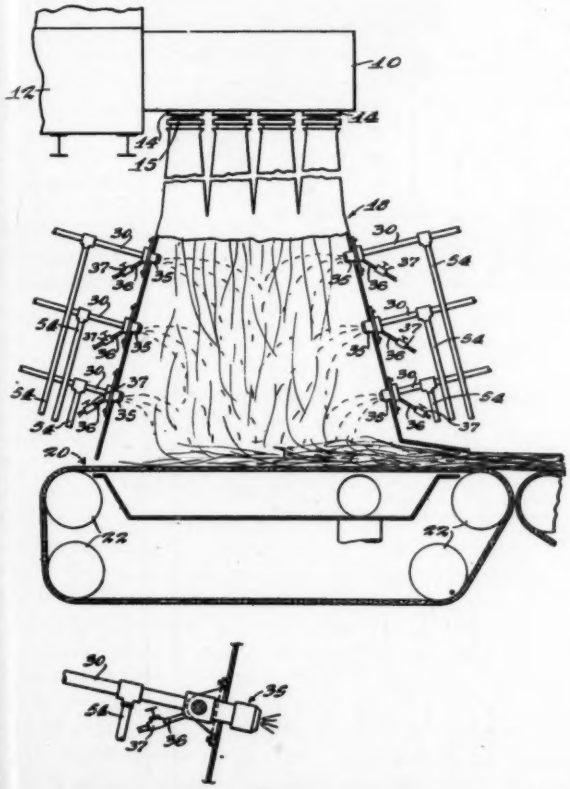


Fig. 4

The present invention embraces the provision of a method and apparatus for introducing an oil or lubricant onto the fibers in a manner, whereby the lubrication characteristics of the oil are fully utilized, without involving emulsification of the oil. Referring to the drawing, Fig. 4, there is illustrated a forehearth 10 which is supplied with molten glass or other heat softenable material from a melting tank or furnace 12. Disposed adjacent and beneath the feeders are blowers 15, there being one blower for each glass feeder. The resin conveying system includes a plurality of tubes or feed lines 30, each of which is individually connected with a metering or flow controlling device. Each of the tubes 30 terminates adjacent a wall of the forming hood 18 and is provided with a nozzle 35 preferably of the steam or gas pressure ejector type for spraying the liquid bonding resin onto the fibers. Each of the ejector nozzles is connected by means of a tube 36 with a source of steam or other pressure fluid providing the motivating force for ejecting the resin and lubricant onto the fibers in atomized condition. The pressure steam lines or tubes 36 may each be provided with a control or regulating valve 37 for controlling the ejection of material from the nozzles. In order to further assure uniform flow characteristics of the oil, it is desirable to employ a heat transfer or heat applying means for maintaining the oil at a predetermined temperature and thus insure a substantially uniform viscosity. This arrangement eliminates the use of an emulsion as the oleaginous liquid or lubricant by introducing the lubricant with the bonding resin.

The patent contains 15 claims and the following references were cited: 1,940,975, Shaver, Dec. 26, 1933; 2,034,008, Taylor, Mar. 17, 1936; 2,055,446, Powell, Sept. 22, 1936; 2,070,194, Bartunek et al., Feb. 9, 1937; 2,189,840, Simison et al., Feb. 13, 1940; 2,224,149, Fisher, Dec. 10, 1940; 2,348,182, Slayter, May 2, 1944; and 2,457,775, Ebaugh, Dec. 28, 1948.

Sheet and Plate Glass

Smoothing and Polishing Runners. Fig. 5. Patent No. 2,707,856. Filed March 5, 1952. Issued May 10, 1955. One sheet of drawings. Assigned to Libby-Owens-Ford Glass Company by Peter Kirkman.

The primary object of this invention is to provide a rotating runner for use with surface apparatus for glass sheets or plates which will distribute the surfacing agent

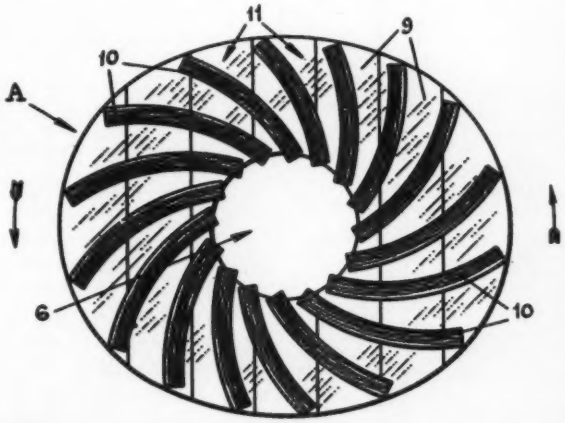


Fig. 5

more uniformly over the faces of the sheets or plates. The runner bars 10, Fig. 5, constitute arcuately shaped vanes or blades which define the substantially triangular pockets 11. The surfacing agent is received by the pockets as it is introduced through opening 6. Upon rotation, the bars will tend to counteract the normal tendency of the surfacing agent to be thrown outwardly from the center of the runner. That is, the spirally arranged bars will oppose the radially directed components of centrifugal force resulting from rotation of the runner. The spirally arranged runner bars are of a novel laminated construction, consisting of alternate layers of rubber and canvas vulcanized together to form a unitary structure. When so constructed and arranged, the bars not only result in a very efficient distribution of the surfacing agent in the abrading process, but also are highly resistant to wear. For example, there is no tendency for the surfacing agent to become embedded in the working surface of the bar as is the case when felt surfaces are used on the runners.

The patent contains fifteen claims and the following references were cited: 159,031, Laird, Jan. 26, 1875; 277,325, Morse, May 8, 1883; 797, 427, Harris, Aug. 15, 1905; 1,622,942, Chase, Mar. 29, 1927; 1,670,780, Mills, May 22, 1928; 1,688,378, Ditmar, Oct. 23, 1928; and 2,083,749, Sword, June 15, 1937.

Apparatus for Suspending Flat Glass During Heat Treatment. Fig. 6. Patent No. 2,710,493. Filed November 29, 1951. Issued June 14, 1955. Two sheets of drawings. Assigned to Blue Ridge Glass Corporation by Theodore W. Glynn.

This invention relates to apparatus for suspending flat glass, such as glass door panels, during heat treatment. Referring to Fig. 6, a carriage is formed from a horizontal channel 1, from the opposite ends of which pairs of parallel legs 2 extend downward. Mounted on top of the channel are pairs of brackets 3, in which are journaled shafts 4 that extend lengthwise of the channel. The shafts have their central portions rigidly connected to the lower parts of yokes 6. The upper ends of the yokes are supported by trolley wheels 7 that run on a track 8 formed by the flanges of an inverted T-bar. With this arrangement of tongs, the load on all of them will be self-equalizing; that is, each pair of tongs will bear the same weight. If one of the tongs suspended from a given lower arm 29 grips a sheet of glass at a lower point than the other tongs suspended from the same arm, the arm will merely tilt so that the weight on each of the tongs will be the same. A problem encountered in tempering flat glass is the tendency of the tongs to bite too deeply into

(*Continued on page* 492)

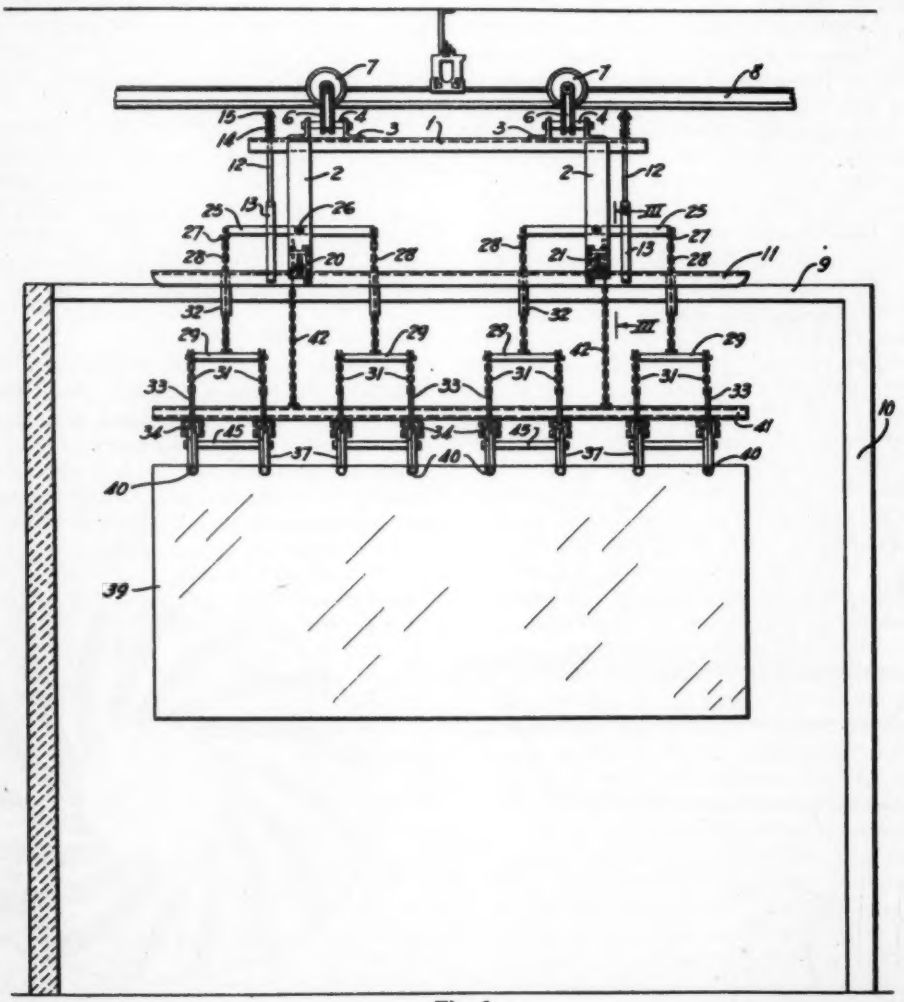
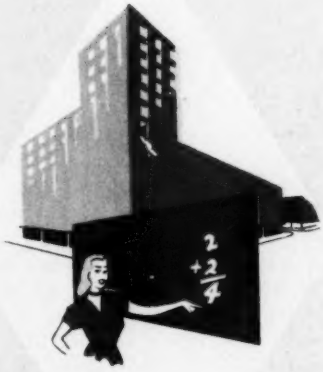


Fig. 6

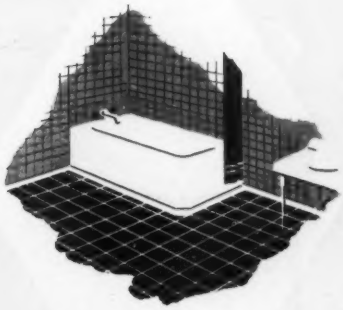
Whatever the product . . .

GLASSWARE
GLASS CONTAINERS



CHALKBOARDS
ALUMINUM ENAMELS

POTTERY
ART WARE



TILE
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Milestones in Glass Progress

PHOTO COURTESY THE CORNING MUSEUM OF GLASS

1820 The expanded-diamond pitcher and sugar bowl, above, were fashioned in shapes peculiar to the Midwest United States in the early 19th century. Glassblowers of that time created such individual pieces in their spare time, to meet local needs. Very rare, these two pieces are attributed to the Zanesville Glass Works, Ohio.

1890 Michigan Alkali Company, now a division of Wyandotte Chemicals Corporation (South Plant, above), was founded by Captain J. B. Ford to supply Soda Ash to the glass industry. Wyandotte has grown up with glass. Today, as in the past, it is a working partner, supplying technical assistance and raw-material chemicals to those great companies marking milestones in glass progress.

Wyandotte
REG. U. S. PAT. OFF.
CHEMICALS

Wyandotte Chemicals Corporation, Wyandotte, Michigan
Offices in Principal Cities

Founded by a Glassmaker to Serve the Glass Industry

NEW INDUSTRIAL SERVICE IN THE INSTRUMENT AND CONTROL FIELD

Panellit, Inc., Skokie, Illinois, announces formation of the new Instrument Service Division to fulfill demands for engineering facilities outside the normal range of company activities.

The new division will provide consulting and installation services in the field of instrumentation and automation. Included will be over-all instrumentation studies and surveys, control system design and comprehensive project supervision. The new Panellit division will handle complete installation of instrument and control equipment including inspection, calibration, check-out and plant start-up.

Neil M. Blair has been appointed manager of the Panellit Instrument Services Division which is staffed by personnel having specific experience in each phase of the new division's activities.

ASSISTANT GENERAL MANAGER NAMED FOR LACLEDE-CHRISTY

William M. Taylor has been appointed Assistant General Manager of the Laclede-Christy Division of H. K. Porter Company, Inc., according to an announcement by C. J. Young, the Division's Vice President and General Manager.

Mr. Taylor joined the Porter organization in 1951 as Market Research and Advertising Manager of the Quaker Rubber Corporation Division. Earlier this year he went to the company's Pittsburgh office as Assistant to the Executive Vice President, C. R. Dobson.

A graduate of Carnegie Institute of Technology and Harvard Business School, Mr. Taylor has had diversified experience in sales, engineering and administration. He began his career with General Electric, later went with Lincoln Electric and before coming with Porter was District Manager and then Assistant to the President for Sales of the Wright Power Saw and Tool Corporation.

DU PONT COMPLETES EXPANSION AND MODERNIZATION OF PLANT

The E. I. du Pont de Nemours and Company has completed a major expansion and modernization of the ceramic research and sales service laboratories at its Electrochemicals Department plant, Perth Amboy, New Jersey, it was announced by L. H. Fletemeyer, Jr., Plant Manager.

The laboratories, under the direction of Dr. Kermit H. Ballard, are fully equipped to carry out fundamental ceramic research and to supply technical service to the ceramics, electronic and other industries. Technical personnel also conduct pioneering research aimed at developing new industrial uses for ceramic materials.

The Perth Amboy plant has been engaged in the manufacture of ceramic colors and precious metals decorations for more than 70 years. The Du Pont ceramics division has developed a diversified group of ceramic products which include a complete line of ceramic enamels and pigments, used for decorating patterns and chinaware, as well as for labeling beverage bottles. Gold, platinum and palladium preparations, another product group, are used for decorating semi-vitreous and fine china and glassware.

Research Digest

Viscometer for Measuring Glass Viscosity

Many methods have been prepared for determining the viscosity of fluids. For glass, in the high-temperature region, the rotating cylinder and falling ball methods seem to be preferred. Little mention has been made of methods involving flow through an orifice, although such methods are widely used with fluids other than glass. Tiede, in the May 1955 issue of the *Journal of the American Ceramic Society*, describes a procedure which has been used for a number of years in the laboratories of the Owens-Corning Fiberglas Corporation. The procedure may be classified as a flow type of measurement, although the glass passing through the orifice is actually converted to fibers.

The apparatus employed is designed to measure the relationship between temperature and the quantity of glass in fiber form which can be drawn from an orifice in unit time. Glass is melted and fibers are drawn from a special device known as a one-hole bushing.

The fibers are wound on a flat pully 3 inches in diameter attached to a 3450 r.p.m. motor placed directly below the bushing. The motor is mounted on a special base which permits rapid manual shifting of its position in a direction parallel to its axis. Electrical connections are made to the bushing by means of two water-cooled clamps. The clamps and bushings are supported by copper bars which lead to the secondary of a special transformer. The bushing is heated as a resistor. The voltage applied may be varied between 0 and 1½ volts. The temperature is accurately controlled by a Wheelco Potentiotrol and saturable core reactor. A separate thermocouple is provided for accurate temperature measurements with a precision potentiometer.

The construction of a one-hole bushing consists of a platinum-alloy crucible 1 inch square and 2½ inches high. It has two terminals for making electrical connections and an orifice or "tip" at the bottom. Two thermocouples are welded in place near the tip. Insulating refractory is fitted around the bushing and held in place by a brass case. A platinum-alloy lid and a cover of insulating brick complete the bushing. About 300 gm. of platinum alloy are required to make a one-hole bushing.

The bushing tip must be carefully constructed. Occasionally, glasses are encountered which are especially difficult to fiberize. In these cases, improvement may often be obtained by changes in the design of the bushing or alterations in the length, hole size or counterbore of the tip. For instance, if the glass were very viscous, it could be made to operate at a lower temperature by using an orifice diameter larger than 0.038 inches. The best design is experimentally determined. Since the measurement of glass viscosity is made on a comparative rather than on an absolute basis, satisfactory results can be expected even if the bushing design is altered. In practice, however, it has been found desirable to make replacement bushings as nearly alike as possible.

Among the advantages of the method described may be listed the following: (1) It is relatively fast. Ordinarily, curves for four glasses can be obtained in an 8-hour day. (2) Data can be obtained over a range of temperatures. (3) It is a measurement at fairly low viscosities. This is of particular value to the fibrous glass industry because the viscosity range covered is the range of greatest interest in production operations. (4) Measurements can be made on a relatively small sample of glass (2 cu. in.). (5) Necessity for calibration is avoided by use of a standard glass. (6) A precision of measurement of $\pm 2°C.$ can be expected when the test glass and standard are of the same type.

The one-hole bushing may have uses other than the determination of viscosity. For instance, fibers produced in a similar unit are often used for testing strength or other mechanical properties of glass. Such fibers provide convenient specimens for durability studies, since they present a large surface, the area of which can be calculated more accurately than that produced by conventional methods of crushing and screening bulk glass.

Results are of particular use to the fibrous glass industry because the similarity of test conditions to those of production often makes possible predictions regarding the behavior of a test glass or experimental composition in production.

There are two objections to the method: (1) Corrections are not made for many factors which affect results. These include glass density, color, surface tension and extent of wetting by the glass of the metal from which the bushing is made. (2) Results are not obtained in absolute viscosity units.

Precautions which must be taken include the following: (1) Drafts or large changes in ambient temperatures must be avoided. For best results, the bushing should be used in a small room in which temperatures can be controlled without inducing serious drafts. (2) The glass selected as the standard must be uniform for reproducible results to be obtained. (3) Frequent standardization of the bushing by use of the standard glass is necessary.

Of the factors which influence results, corrections could be easily made for the effect of density since the weight of the glass delivered is proportional to the square of the density. It is assumed that the effects of such factors as density, surface tension and color are canceled when the test glass and standard are similar. If the test glass differs from the standard, these factors may introduce errors. However, similar test glasses may be compared with each other by reference to a dissimilar standard. Thus, it has been found practical to use the measurement as a control for an operation using a glass different from the standard, even though no corrections are made for the differences in glass properties.

It does not appear to be practical to calculate absolute viscosities from data obtained with the one-hole bushing. Certainly the formulas for viscosity usually applied to flow measurements, such as Boiseville's equation, do not apply vigorously in this case. The orifice is of a complicated shape, the temperature distribution through the

(*Continued on page* 495)

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during June 1955 was as follows: *Flat Glass:* A preliminary figure of 29,300 for June indicates a rise of 2.4 per cent from the adjusted 28,600 reported for May. *Glass and Glassware, Pressed and Blown:* An increase of 1.6 per cent is shown by the preliminary June figure of 80,200 when compared with May's 78,900. *Glass Products Made of Purchased Glass:* The preliminary 14,700 indicates no increase or decrease from the previous month's 14,700.

Payrolls in the glass industry during June 1955 were as follows: *Flat Glass:* An increase of 2.8 per cent is shown in the preliminary $14,602,436 when compared with May's adjusted $14,199,172. *Glass and Glassware, Pressed and Blown:* A decrease of 4.4 per cent is shown in the preliminary $24,181,112 reported for June when compared with the previous month's adjusted $25,317,695. *Glass Products Made of Purchased Glass:* A preliminary figure of $4,030,299 was reported for June. This is 1.9 per cent lower than the adjusted May figure of $4,110,561.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

Narrow Neck Containers

	July 1955
Foods	1,217,000
Medicinal & Health Supplies	964,000
Chemicals, Household & Industrial	773,000
Beverages, Returnable	1,108,000
Beverages, Non-returnable	122,000
Beer, Returnable	293,000
Beer, Non-returnable	868,000
Liquors	683,000
Wines	289,000
Toiletries & Cosmetics	798,000
Sub-total (Narrow)	7,115,000

Wide Mouth Containers

Foods	*2,941,000
Dairy Products	212,000
Medicinal & Health Supplies	278,000
Chemicals, Household & Industrial	142,000
Toiletries & Cosmetics	156,000
Packers' Tumblers	152,000
Sub-total (Wide)	3,881,000
Total Domestic	10,996,000
Export Shipments	209,000
TOTAL SHIPMENTS	11,205,000

*This figure includes Fruit Jars and Jelly Glasses.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All Figures in Gross)

		Production July 1955	Stocks July 1955
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	4,200,000	5,174,000
	Wide Mouth	3,822,000	5,209,000
Dairy Products		232,000	367,000
Beverages, Returnable		1,092,000	1,158,000
Beverages, Non-returnable		121,000	245,000
Beer, Returnable		321,000	297,000
Beer, Non-returnable		831,000	720,000
Liquors		765,000	943,000
Wines		304,000	502,000
Packers' Tumblers		170,000	190,000
TOTAL		11,858,000	14,805,000

*This figure includes Fruit Jars and Jelly Glasses.

Glass container production, based on figures released by the Bureau of Census, was 11,858,000 gross during July 1955. This represents a drop of 2.9 per cent from the previous month's production of 12,219,000 gross. During July 1954, glass container production was 10,810,000 gross or 9.6 per cent under July this year. At the end of the first seven months of 1955, glass container manufacturers have produced a total of 78,717,000 gross. This is 5.2 per cent over the 74,803,000 gross produced during the corresponding 1954 period.

Shipments of glass containers during July 1955 decreased 8.9 per cent to reach 11,205,000 gross. This is a decrease from June shipments which were 12,330,000 gross. Shipments during July 1954 were 10,105,000 gross or 10.8 per cent under July 1955. At the end of the first seven months of 1955, shipments have reached a total of 76,260,000 gross, which is 7.1 per cent above the 71,167,000 gross shipped during the corresponding period last year.

Stocks on hand at the end of July 1955 were 14,805,000 gross. This is 3.3 per cent above the 14,327,000 gross on hand at the end of June 1955 and 3.3 per cent higher than the 14,329,000 gross on hand at the end of July 1954.

Automatic tumbler production during June 1955 was 5,668,678 dozens. This is a gain of .3 per cent over May 1955 production which was 5,647,414 dozens. Production during June 1954 was 4,962,647 dozens. Shipments during June 1955 dropped to reach 5,527,019 dozens. This is 1.6 per cent lower than May's 5,618,054 dozens. During June 1954, shipments were 5,398,843 dozens. At the end of the 12-month period ending June 1955, shipments have reached a total of 61,635,503 dozens, which is .5 per cent higher than the 61,321,009 dozens shipped last year.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware during June 1955 gained 5.7 per cent to reach 2,995,743 dozens. This is a gain from May's 2,834,307 dozens. During June 1954, sales were 2,826,791 dozens. At the end of the 12-month period ending June 1955, manufacturers had sold a total of 37,710,717 dozens which was .2 per cent higher than the 37,604,438 during the corresponding 1954 period.

• The Brockway Glass Company announces the transfer of Grant Emery from its Kansas City office to its Cincinnati office. Warren Reeves has joined the sales force of the Brockway Glass Company, and is located in the New York City office. He was formerly with Mays and Gleason of New York. Joseph Drummey has joined the company's Boston sales office.

JOSEPH M. NESTER, PRESIDENT OF OBEAR-NESTER, DIES AT 37

Joseph M. Nester, President of Obear-Nester Glass Company and past-President of the Glass Container Manufacturers Institute, Inc., died in St. Louis, Monday afternoon, August 22nd, at Barnes Hospital after a five-month illness. Mr. Nester, 37, had been President of the Obear-Nester Glass Company of East St. Louis, Illinois, since January 1, 1949, and of the Lincoln Container Corporation of Lincoln, Illinois, since July of 1952.

Born in East St. Louis on June 25, 1918, Mr. Nester attended Belleville Township High School and was graduated in the upper ten per cent of his class in June 1936. Four years later he was awarded a B.S. degree from the school of Commerce at the University of Illinois at Urbana, Illinois.

When he was fifteen, Joe Nester began learning the glass business by working after school and during summer vacations in various production jobs at the Obear-Nester Glass Company. For a year after college he worked at the company and, from 1941 to 1946, served as a Special Agent of the Federal Bureau of Investigation with headquarters in Washington.

Early in 1946 Joe Nester returned to East St. Louis and the glass business, assuming the post of assistant production superintendent. He was named Plant Manager in 1948 and was elected President in January, 1949.

Mr. Nester was the third Joseph Nester to hold the post of president since the company was founded by his grandfather in 1891. While Mr. Nester had only attained the age of 37, he was considered a leader of the glass container industry and an outstanding business executive. He retired as President of the Glass Container Manufacturers Institute in May, 1955 and at the time of his death was serving on its Board of Trustees.

Mr. Nester is survived by his widow, Mary Jean Corns Nester and a daughter, Mary Ann. Also surviving are his parents, Mr. and Mrs. Joseph K. Nester and a sister, Mrs. Earl Millard.

MANIFOLD & PHALOR PURCHASES A. B. KNIGHT OF FAIRMONT

It has been announced that the Manifold & Phalor Machine Company has purchased the entire stock, patterns, prints and manufacturing rights from A. B. Knight of Fairmont, West Virginia, manufacturer of glass machinery for over 50 years.

Manifold & Phalor has moved all of this to Reynoldsburg, Ohio, ten miles east of Columbus on U.S. Route 40 and are now set up and are proceeding to make and stock spare parts and to build new machines.

Frank Stansberry, who was Mr. Knight's shop superintendent for many years and who has had much experience in building and assembling Knight machines, is now working for Manifold.

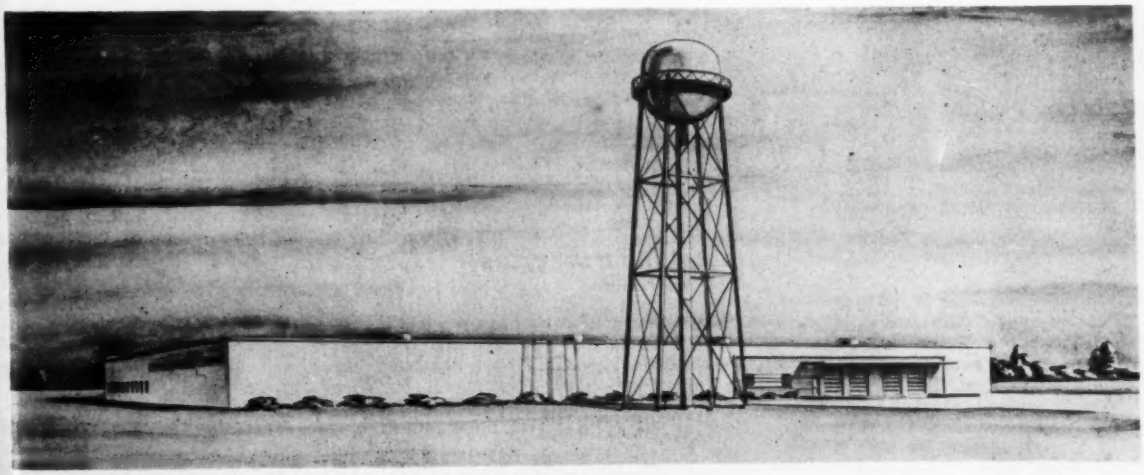
L.O.F GLASS FIBERS BUILDING NEW PLANT AT DEFIANCE, OHIO

Contract for construction of a modern plant facility for the L.O.F. Glass Fibers Company was awarded today to the Paul C. Peters Company, Toledo.

This is the company's second major facility in the Defiance area. In 1950, L.O.F. Glass Fibers purchased the 175,000 square foot plant of the former Defiance Machine Works at Third and Perry Streets in downtown Defiance and began production of glass fiber insulation products. Full scale production will continue at that facility which will be known now as Defiance Plant No. 1. Frank Van Kirk, present manager of Plant No. 1, will also manage the new facility.

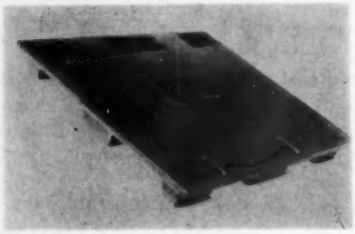
The new plant, to be known as Defiance Plant No. 2, will be located at the eastern edge of Defiance.

The main structure, 100,000 square feet in size, will be used for storing insulation products manufactured at Defiance Plant No. 1 as well as various types of light fabrication. A 5-car depressed siding is planned along with a three-truck capacity loading dock.



Defiance Plant No. 2

New Equipment and Supplies



MATERIALS HANDLING PALLET

Firmaline Products, Inc., Midland Park, New Jersey, has developed a new type of materials handling pallet weighing only 28 pounds. It is molded of Bakelite polyester resins reinforced with Fiberglas to support 3,000 pounds of working load. High strength at low weight combined with resistance to wear, abrasion and impact provide means for lowering operating costs in materials handling.

Resistant to oils, grease, acids and alkalies, Bakelite polyester resins molded into the new pallet have a surface that is easy to keep clean and sanitary by steam sterilizing at temperatures up to 325°F. Molding the pallet of reinforced plastic eliminates the need for nails or fasteners which can loosen and damage a cargo.

Nine hollow legs molded in one strong piece with the platform they support are spaced to allow a four-way approach for fork lift trucks. Resting on the outside legs only, the pallet is designed to support working loads of 3,000 pounds, or 200 pounds per square foot. Two pallets nested together have nearly double the strength of one and thus eliminate the need for heavy-duty units to manage extra-heavy cargoes. This flexibility and resilience permits rough handling without cracking and splintering the pallet.

MASONRY BLADES

The Carborundum Company, Niagara Falls, New York, has announced a new and complete line of masonry blades called the "Niagara" line. This line provides blades that will cut all types of brick, concrete products, stone, tile and non-metallic pipe, as well as asbestos, cement, gypsum, transite, masonite, celotex, etc.

These blades are easily selected for cutting operations by their simple numerical coding system. Yellow blotters identify wet cutting blades manufactured of silicon carbide with a waterproof resinoid bond. Blue blotters identify dry cutting blades of resinoid bonded silicon carbide. Blades marked with a green blotter are new "Carboflex" fiber glass reinforced cut-off wheels that combine fast cutting action with high strength. These wheels are specially reinforced to provide extreme safety. Their knurled sides permit free cutting action without side binding.

SPRAYWELD POWDER

Wall Colmonoy Corporation, 19345 John R Street, Detroit 3, Michigan, has developed a new series of Colmonoy alloy powders which produce improved deposit efficiency when used in Spraywelded hard-facing applications.

Research has resulted in powders of the nickel-chromium-boron alloys, Colmonoy No's. 4, 5 and 6, having as much as 10 per cent improvement in deposit efficiency. Better deposit efficiency means less powder is required to produce a given thickness of protective coating as sprayed on the item in question.

Spraywelding, which is faster than rod methods for overlaying surfaces with hard-facing alloys, is even more quickly accomplished with the new improved powders. Lower hard-facing cost results from reduction in Spraywelding time, as well as from reduction in amount of material required where the new material is used. The nickel-base alloys provide wear, corrosion, heat impact and galling resistance. They are available in units of 5 pounds, packaged in metal containers.

New improved hard-facing alloy powders are available as Colmonoy No's. 4, 5 and 6. Colmonoy No. 4 produces Rockwell hardness of 35-40 on the C scale. Its specific gravity is 8.22, its melting point 2025°F. It has excellent corrosion resistance, red hardness and weldability; very good impact and galling resistance; and good abrasion resistance. Colmonoy No. 5 produces Rockwell hardness of 45-50 on the C scale. Its specific gravity is 8.14, its melting point 1950°F. It has excellent corrosion resistance, red hardness and weldability and very good abrasion, impact and galling resistance. Colmonoy No. 6 produces Rockwell hardness of 56-61 on the C scale. Its specific gravity is 7.80, its melting point 1900°F. It has excellent abrasion, corrosion and galling resistance; excellent red hardness and weldability; and good impact resistance.

INFRARED RADIATION PYROMETER

Servo Corporation of America, 20-20 Jericho Turnpike, New Hyde Park, Long Island, New York, manufactures an infrared radiation pyrometer. By remote detection of infrared radiation, this instrument measures temperature variations in situations where thermocouples, thermopiles and other devices are inadequate or inoperative. Covering a nominal temperature range of ambient to 1000°C., the pyrometer is suited for very fine measurements. As a process measurement or control instrument, it is excellent for processes requiring high sensitivity near ambient.

The pyrometer indicates temperature variations as small as 0.1°F. and much smaller variations may be obtained when the system is operated by an experienced technician. Its response time is 25 milliseconds. While the equipment has its own meter, the output may be fed to a recorder for more permanent records.

FLUORESCENT TUBE RACKS

The Frick-Gallagher Manufacturing Company, Wellston, Ohio announces a safe and convenient method for storing crushable fluorescent tubes, fixtures and similar materials.

Without running the risk of damage to packages or contents, long, narrow, fragile cartons may now be stacked to ceiling height in new steel racks, thus making possible the most efficient use of materials. Different types of cartons may be stored separately in these racks.

Designed for installation one on top of the other, the racks measure 5′ wide, 4′ deep. Standard heights are 5′, 6′ and 7′. Capacity per shelf is 625 pounds. The top shelf is 11-ga. steel and the frames are 2″ x 2″ x ¼″ steel angle. The members are bolted together. There are three models available.

CATALOGS RECEIVED

Barber-Colman Company, Wheelco Instruments Division, Rockford, Illinois, has issued a new bulletin, F 5795-2, describing how the Wheelco Capaciline, a supplementary control device, "anticipates" the fuel needs of controlled heating equipment and enforces straight line control on the process variable.

In the Wheelco Capaciline, heat transfer lags are anticipated and compensated for by means of a unique and simple electrical network and relay circuit, synchronized with the measuring system and controlling circuits, without affecting accuracy of the temperature reading at the control point.

Diamond Alkali Company, Union Commerce Building, Cleveland 14, Ohio, has prepared a handy checklist. Prepared as a guide to available literature covering Diamond Chemicals and their diverse uses, this compilation of technical and non-technical information may prove of interest and value.

Included in the checklist are reference manuals and handbooks, technical bulletins and data sheets, product folders and leaflets and miscellaneous publications.

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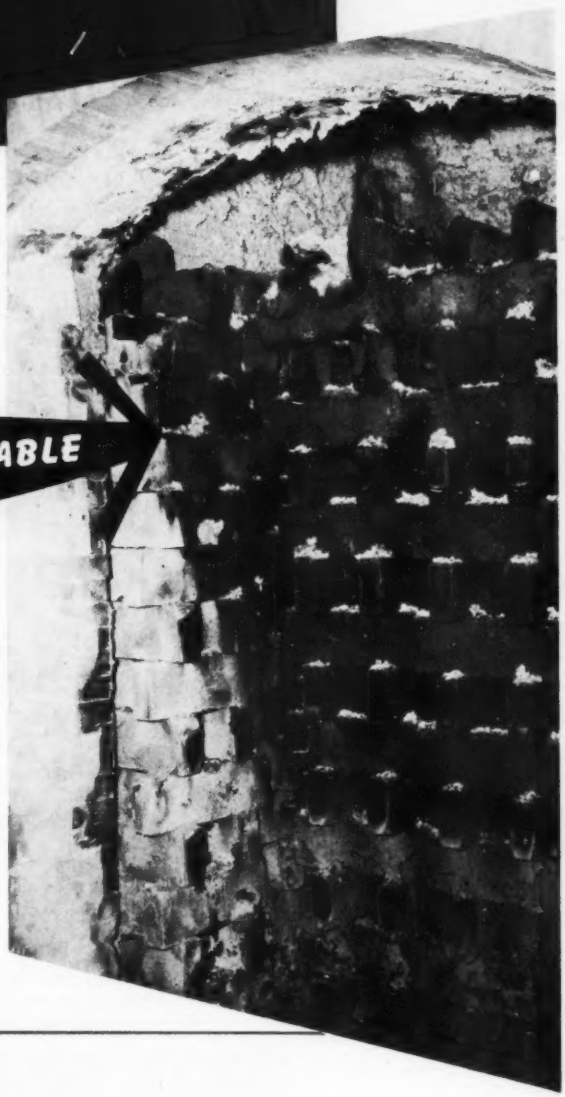

Through a three-year campaign of hard service Harbison-Walker FORSTERITE L Checkers in the regenerator of a large soda-lime furnace producing flat glass continued to function at a high rate of efficiency, because of their excellent resistance to severe fluxing and to clogging.

At many plants producing soda-lime glass, costly interruptions for mid-campaign checker replacements are avoided by the use of FORSTERITE L.

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ARMSTRONG APPOINTS MANAGER OF GLASS CONTAINER SALES

Robert M. Ulmer has been appointed Manager of Glass Container Sales for the Armstrong Cork Company, it was announced by Roger H. Hetzel, General Sales Manager of Armstrong's Glass and Closure Division. Mr. Ulmer succeeds P. S. Holmquest, who has resigned.

Mr. Ulmer, a graduate of Lehigh University, joined the Armstrong organization in 1941 as a sales trainee and was assigned to the Chicago office. After serving four years in the Army, attaining the rank of Major, he returned to the Chicago office and later served as resident salesman in Milwaukee. In 1952 he was appointed Assistant Manager of Glass Container Sales, serving first at Dunkirk, Indiana, where one of Armstrong's two glass plants is located, and later at the Company's General Offices at Lancaster.

• American Wheelabrator & Equipment Corp., Mishawaka, Indiana announces that it has changed its corporate name to Wheelabrator Corporation, effective immediately.

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MOLD DESIGN ENGINEER. Experienced in container designs interested in employment with West Coast bottle manufacturer. Reply P. O. Box 3758, Terminal Annex, Los Angeles, California.

SITUATION WANTED

GLASS TECHNOLOGIST (British), aged 39 years, with experience in research and industrial technical management requires *active* post in glass, refractories or allied trades. Dr. J. Boow, 92, Abbey Lane, Sheffield, 8, England.

BALL BROTHERS APPOINTS CONTROLLER

The appointment of Howard H. Ward to the position of controller was announced by Ball Brothers Company, Inc.

Mr. Ward is a graduate of the College of Commerce, University of Illinois. He formerly was associated with Olin-Mathieson Chemical Corporation and had been acting controller at Ball for the last seven months.

Mr. Ward served in the Army four years during World War II, and after the war rejoined the Olin organization at their East Alton, Illinois plant.

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GLASS TIME CAPSULE BURIED IN O-I GROUND-BREAKING CEREMONY

The burying of a glass time capsule, containing mementos of the day's event, highlighted the ground-breaking for a glass container plant in Portland, Oregon. The plant, scheduled to be one of the most modern of its kind in the nation, is being constructed by Owens-Illinois and is expected to be completed by mid-1956.

Oregon state, county, and city civic leaders joined Owens-Illinois officials from the company's general offices in Toledo, Ohio, and from Pacific Coast cities, in breaking ground and burying the sealed glass container on the plant site.

The capsule, in the form of a sealed, 5-gallon bottle, contained latest editions of Portland newspapers, a rosebud (symbolic of the city), a program of the day's events, a photograph of President Eisenhower and items representing other industries in the Northwest. It will remain buried until the year 2006.

Turning the first shovelful of earth, marking the start of construction on the plant, was Miss Nancy Wyly, 1955 Portland Rose Queen.

BOOK REVIEW

Handbook of Engineering Materials
Edited by Douglas F. Miner and John B. Seastone

The materials of manufacturing and construction in all branches of engineering are brought together for centralized identification and working comparison in Handbook of Engineering Materials," the new source book edited by Douglas F. Miner and John B. Seastone. This represents the combined resources of 51 specialists from numerous fields.

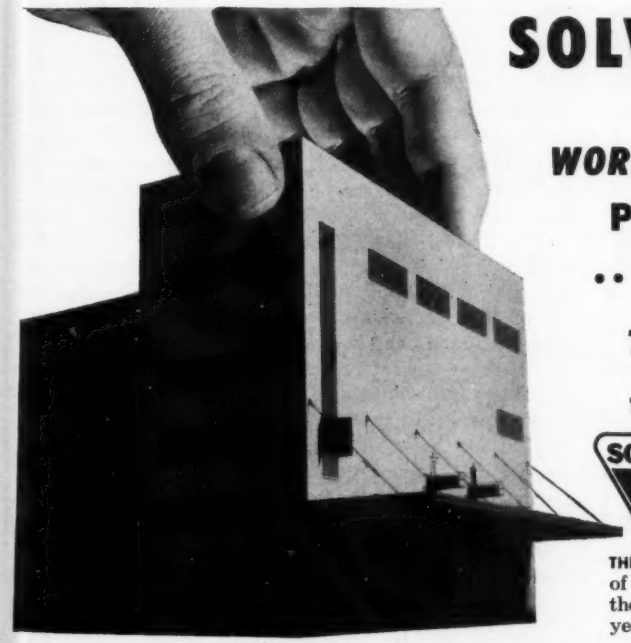
The increasing tendency for one branch of engineering to overlap with another provided the basic need and impetus for this exhaustive reference work. Here, the technical properties take precedence, with the book's emphasis on selection and use of material, and major attention directed to adaptability to fabricating methods, availability, costs and limitations.

Arranged by classes of related or similar materials, it provides general information on specifications and standards, statistics in the application of materials and mathematical and physical tables. The second section is devoted to metals and includes ferrous metals, aluminum, magnesium, copper and its alloys, zinc, nickel and its alloys, other pure metals and special purpose metals and alloys.

Details for non-metals are given in the third section. Wood and woodbase materials, paper, fibers, plastics and rubbers, organic finishing materials, fuels, carbon products, ceramic materials, industrial chemicals and lubricants are the individual materials treated here.

Construction materials are covered in the final section, with the analysis directed to cementing materials and concretes, roadbed materials, timber, rope, foundations, weather and moisture protection and glass products.

Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York City; 1328 pages; price $17.50.



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Segmental Loading . . .
(*Continued from page* 471)

steel strapping and anchor the load to the car in segments.

In order to find out just what happens to one of these strapped segmentized loads, we conducted some impact tests with one earlier this year. Some of our objectives were: (1) To observe the straps, anchors and seals after impact. (2) To study the bulkheads used in various locations for design and function. (3) See which type end anchored and held more securely—the flat end or the pyramid end. (4) To see whether the upper or the lower part of the load required the heaviest strapping. (5) To see if the thrust line of the crate was stiff enough to properly protect the glass.

Car No. MKT 99496 was loaded with 84 pallets of window glass, ready for shipment to the customer and valued at several thousand dollars. With the cooperation of the "Frisco" Railroad officials, the car was moved to the local "Frisco" switch yard. The same procedure was followed in testing this car as was used in the tests reported in the April, 1954 edition of THE GLASS INDUSTRY. For test purposes, all speeds above 4 m.p.h. were considered in the rough handling category, as outlined by the railroad people. In loading this test car, the load was divided into six segments, each segment being anchored to the car sidewalls with 1¼ x .035 steel straps allowing one strap for each 4000 lbs. of the load to be held in place, see Fig. 12. This allows a large safety factor. Fifteen pallets weighing about 1300 lbs. each were loaded in each end of the car and a three board bulkhead placed across the face of the pallets using five steel straps anchored to the sidewall of the car to hold it in place. This placed about one-sixth of the load in each of the ends of the car. This operation was repeated and the second bulkhead placed in front of the next fifteen pallets in each end of the car. More pallets were placed against these bulkheads ranging toward the door of the car where, on one end of the car, the pallets were stopped in an even line across the car and a bulkhead placed in front of them (see Fig. 6) with the center of the bulk about 8″ thick and the edges about 3″ thick giving about a 5″ rise in center. Straps were passed around this bulkhead and sealed tight.

The opposite end of the car was finished in our usual fashion, using a pyramid. This is accomplished by placing a light bulkhead across the face of next to last row of three pallets, then placing two pallets centered against this bulkhead. Then a light bulkhead, the length of the two pallets, is installed and the last pallet centered against this bulkhead, with a final small bulkhead, the size of one pallet, placed in front. The straps are passed around this pyramid and sealed as shown in Fig. 7. The car was lined up on a straight track, at one end of which a string of loaded coal cars with brakes set formed a bumper. The car was pushed toward the coal cars and disconnected from the engine and just before hitting the bumper was clocked for m.p.h. by stop watch over two fixed points with a given distance between.

The impact recorders, one belonging to us and one to the "Frisco," were set to check the impact on the horizontal plane parallel to the rails. The first impact at 2 m.p.h. car speed registered in the first half of Zone 1 on the impact recorder and no damage resulted. Successive impacts, as shown on the bar chart Fig. 2, were given this car and it held up satisfactorily. Seven of the ten impacts registered were in the rough handling category, according to the railroad people. Movies taken during the impact testing of this car revealed that the pyramid end of the car moved very little on impact and the center did not seem to move any more than the edges of the load. Whereas, the opposite end with the bulkhead having only 5″ rise, the center of the load or middle row of pallets and the adjoining edge of the other two rows would spring forward on impact perceptibly. We decided, from the results of this test, that the straight front bulkheads should have about a 10″ rise and bear on the 1/3 points where the pallets join, as shown in Fig. 8, because the forward thrust in the center tended to rock the side pallets to a certain extent and to loosen the nails some. The pyramid type end still appears to be the most secure on the long rough haul.

Fig. 12

All straps held, although the top ones became looser than the lower ones, developing about a finger width of slack, as shown in Fig. 9. Staples held the straps in proper line and prevented slipping down. All seals held tight. The looseness in straps appeared to have resulted from tightening of slack in the anchor plates, plus stretch.

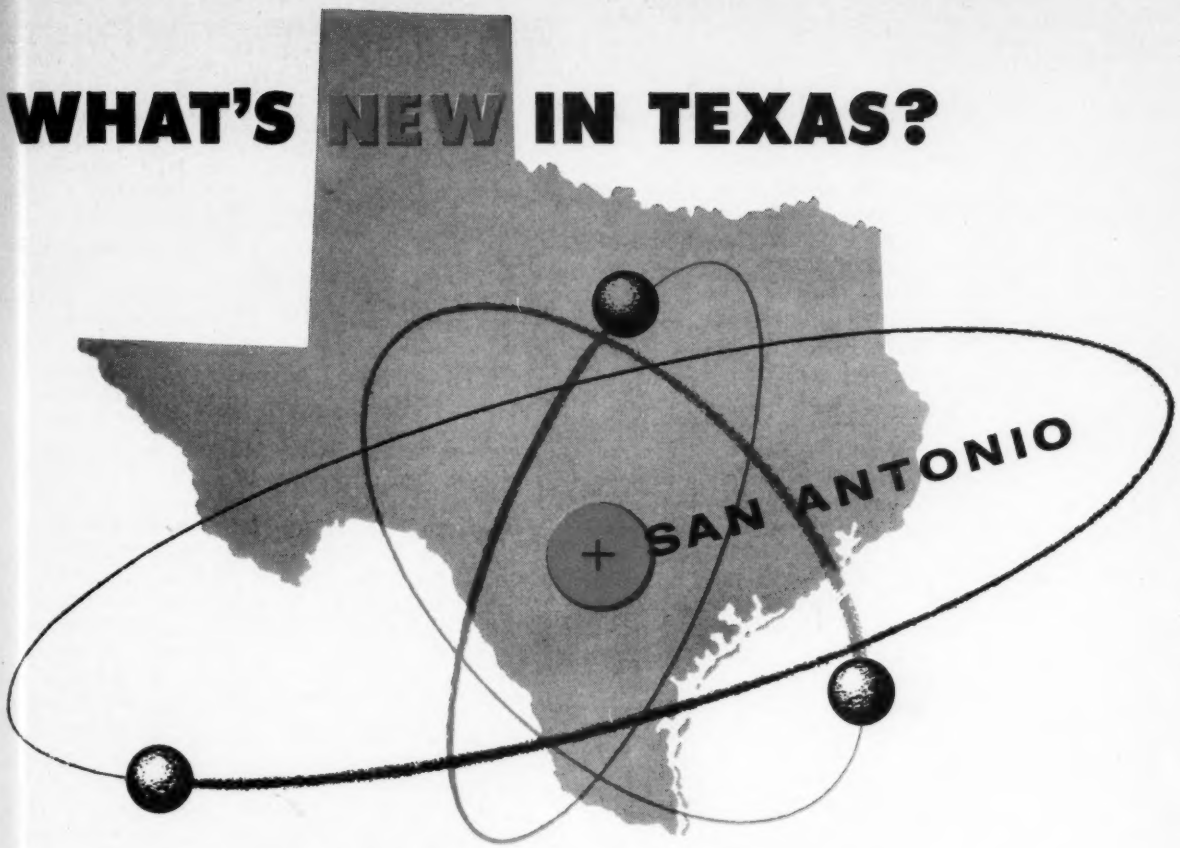
For bulkheads between the segments, 2 x 4 rough oak uprights were placed, one at each edge of car and one at each joint between the three rows of pallets. To these four posts were nailed 1 x 8 rough oak members at the floor line and at the top of the pallets with 1 x 6 rough oak nailed to center. These 1 x 6 oak boards were cut 2″ shorter than width of car and opposed each other on the two faces of the bulkhead, as in Figs. 10 and 11. The end bulkheads found to be very satisfactory are similar to those shown in Figs. 7 and 8.

This load of window glass weathered the testing procedure in good condition which was evident by the fact that after all tests were completed, the car was shipped on to the customer without reblocking or restrapping and it was reported to have arrived in good condition.

What are "Safe Loading Impacts?" We have evolved the idea that they are the ones that our product and load will take without damage and by these simple tests and this type of practical research, our damages as a result of impacts have been reduced. How much impact will your load stand and still give you a satisfied customer at destination may still be a good question.

Note: The next scheduled tests are set for the week of September 12, 1955, for which we have secured the use of a specially built railroad car, owned by the "Frisco," having a built-in speedometer, shock recorders, and is cut away so the load can be viewed from the outside while it is under test. We plan slow-motion movie studies of the studies of the effect of impact on certain types of load and packages.

WHAT'S NEW IN TEXAS?



NEW SOURCE OF Lithium CHEMICALS

Now under construction in San Antonio, Texas, the new $6,600,000 plant of American Lithium Chemicals, Incorporated, will help meet Industry's growing demand for lithium products. This new source of supply, an affiliate of American Potash & Chemical Corporation, will process high-grade lithium ores from extensive deposits in Southern Rhodesia. The initial production in San Antonio of lithium hydroxide, added to the present lithium carbonate output at Trona, California, now assures a substantial increase in domestic supply of lithia, used in its various forms in quality glassware, porcelain enamel glazes, lubricating grease, storage batteries, heat treating operations and humidity control. You can take advantage of this major step in American Potash & Chemical's program of expansion in the lithium chemical field by including this new source in your future lithium plans.

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LITHIUM CARBONATE • LITHIUM HYDROXIDE • LITHIUM BROMIDE • LITHIUM CHLORIDE and other LITHIUM CHEMICALS

Inventions and Inventors . . .

(*Continued from page* 480)

the glass when it is softened by heat in the furnace, due to the fact that the weight on the tongs continually urges their handles, and therefore, their jaws, toward each other. This problem is solved by inserting a solid metal rod 45 between the handles of the tongs below each different lower arm 29. The rods serve as blocks that prevent the handles from being moved any closer together, so the jaws of the tongs cannot imbed themselves farther into the glass when it becomes softened in the furnace.

The patent contains 3 claims and 11 references.

Multi-Layer Glass Sheet. Patent No. 2,710,274. Filed March 26, 1952. Issued June 7, 1955. One sheet of drawings (none reproduced). Georg W. Kuehl.

This invention relates to a multilayer glass sheet and more particularly to a multilayer glass sheet the transparency of which is reversibly variable with changes in temperature and/or luminous intensity. Changes in the transparency of the intermediate layer are effected in an especially suitable manner by changes in temperature. It is, therefore, of advantage to admix to the intermediate layer substances which have the property to absorb light and which thereby convert such light into heat. Copper sulfate is especially suitable for this purpose. For the purpose of displacing the point of conversion, the intermediate layer may contain one or more substances which are capable of favorably or unfavorably influencing the sol state. Salts of alkyl sulfonates or neutral salts of derivatives of naphthalene sulfonic acid, such as "Cyclanon" and "Tamol" marketed by Badische Anilin- & Soda- Fabrik, Ludwigshafen. Changes in the transparency of the intermediate layer may furthermore be caused by adding to the intermediate layer substances which, on exposure to light, are reversibly photochemically converted thereby forming substances of different transparency. The intermediate layer may, for instance, contain leucocyanides or carbinol bases of certain dyestuffs, such as the leucobases of pararosaniline, crystal violet, malachite green, brilliant green, victoria blue and others. Numerous examples are given of materials that: (A) Intermediate layers which are reversibly converted from the sol state to the get state. (B) Intermediate layers the color of which is reversibly changed. (C) Intermediate layers which are reversibly photochemically converted.

The patent contains sixteen claims and twelve references.

Miscellaneous Processes

Bottle for Liquid Dairy Products. Fig. 7. Patent No. 2,708,049. Filed March 5, 1952. Issued May 10, 1955. One sheet of drawings. Edward Sokolik.

The upper portion 9 embraces a pair of superposed annular projections in the form of a pouring lip 11 and a flange 12 having an annular channel 13 formed in the top surface for collecting and holding the drainage from the pouring lip 11. The outer surface 14, co-extensive between the pouring lip 11 and the flange 12, is a draining surface in the form of an annular S with the upper loop substantially abbreviated and the lower loop forming the channel 13 into which it drains from the pouring lip 11. The pouring lip 11 forms the head, with a pouring orifice formed therein, of the neck portion 8. It is provided with an acutely curved annular dropping bead 15 sharply to cut off the pouring stream when the pouring bottle is

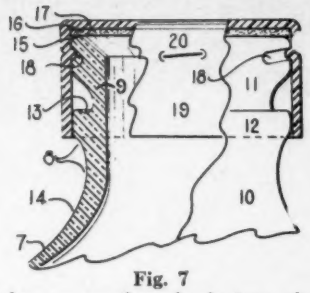


Fig. 7

being arighted. This pouring lip 11 is substantially projected and reinforced and has a top surface that slopes radially inwardly and downwardly to the pouring orifice, preferable right from the divide 16 of the dropping bead 15, to drain the top surface back into the orifice which may be provided with an annular recessed seat for a disc cap. The periphery of this pouring lip 11 is provided with one or more sections of internal screw-thread-like means 18 in a horizontal plane, each angled like a screw-thread terminating open at the top edge of the periphery of the pouring lip 11. The bottle may be poured and handled with facility not soiling the hand and consequently not slipping out of the hand.

The patent contains one claim and the following references were cited: 1,977,589, Merolle, Oct. 16, 1934; 2,056,171, Desckner, Oct. 6, 1936; 2,097,912, Burnham, Nov. 2, 1937; 14,552, Great Britain 1894 and 900, Great Britain 1900.

Composite Mirrors of Large Area in Particular for Concentrating Solar Energy. Fig. 8. Patent No. 2,707,903. Filed April 10, 1952. Issued May 10, 1955. Three sheets of drawings. Assigned to Centre National de la Recherche Scientifique (C.N.R.S.) by Felix Trombe.

The present invention relates to curved mirrors of large area (several thousand square meters), for instance spherical, parabolic, cylindrical mirrors, in particular for concentrating solar energy. It is known to constitute such mirrors by the assembly of a multiplicity of plane reflecting elements mounted in suitable positions on respective supports. In order to obtain a satisfactory concentration of energy by such a mirror, it is necessary to make use of a very high number of plane elements and it

(*Continued on page* 496)

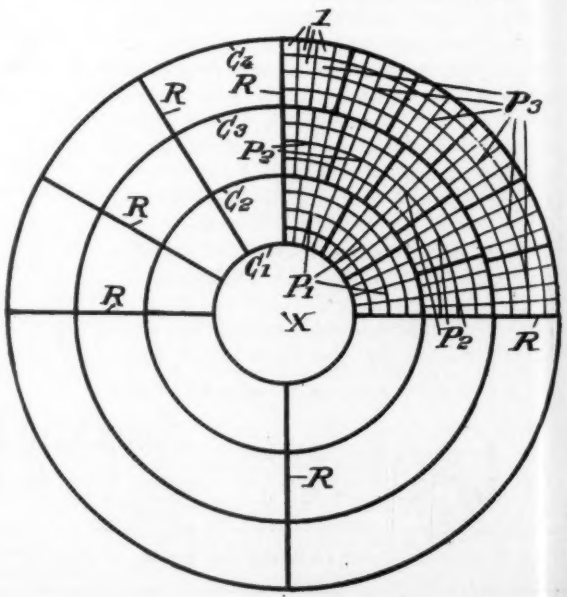
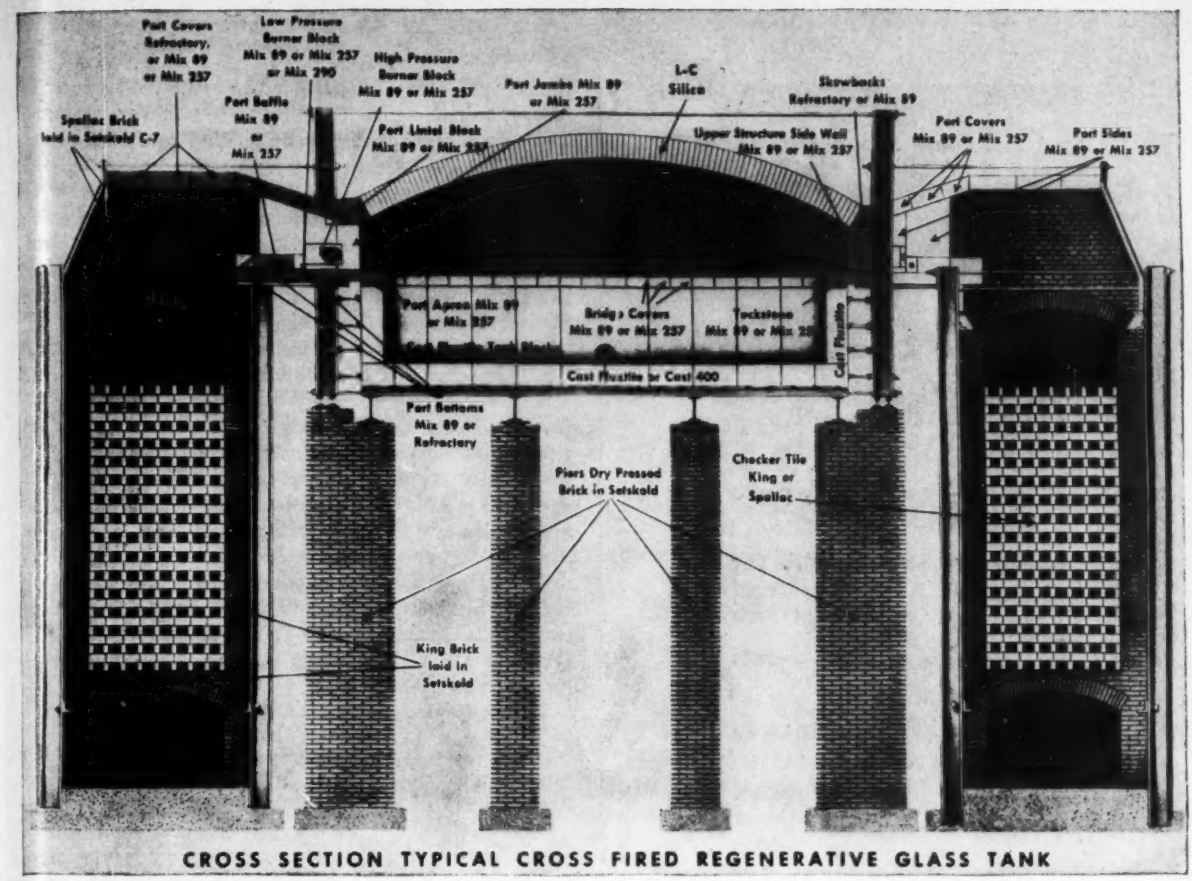


Fig. 8


Port Covers Refractory, or Mix 89 or Mix 257
Low Pressure Burner Block Mix 89 or Mix 257 or Mix 290
High Pressure Burner Block Mix 89 or Mix 257
Port Jambs Mix 89 or Mix 257
L-C Silica
Skewbacks Refractory or Mix 89
Port Covers Mix 89 or Mix 257
Port Sides Mix 89 or Mix 257
Spellac Brick laid in Setskold C-7
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Port Lintel Block Mix 89 or Mix 257
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Metal Defects • • •
(*Continued from page* 467)

in excess of 8,000 tons per day was employed in order to prevent everything from melting, some stones are inherent. These same raw materials upon melting gave off approximately 20 tons of gas per day. Therefore, some bubbles and seeds were inherent in the process. Also, there is an infinite number of combinations of the seven basic oxide components of which our glass is composed, most combinations of which would produce a transparent glass having its own definite physical and chemical properties. Therefore, some ream was inherent in the process.

Where may the line be drawn between efficient operation and an operation containing excessive scrap factors? The Ford Motor Company has only one plate glass furnace. The glass which is melted today may be in an automobile tomorrow. Our only efficiency comparison is based upon past performance of our own operation. Our goal is to produce glass containing no defects other than those which are inherent in the process. How far short of that goal do we presently stand? I, for one, would like to see the members of this Conference and of the Glass Division of the American Ceramic Society establish and then publish such a performance standard. The trend of this performance standard would reflect our progress as an industry through the years.

• N. Kreidl was appointed to the Glass Panel of the American Ceramic Society Advisory Board to the National Bureau of Standards.

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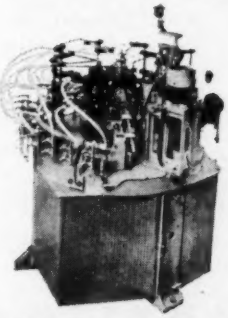

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FOURTH INTERNATIONAL CONGRESS TO BE HELD JULY 1956

The 4th International Congress on Glass will meet July 2 to July 6, 1956 in Paris, France.

In order to secure adequate discussion, complete manuscripts must be in the hands of the President and Secretary of the Commission and the Paris Committee by March 1956.

All papers received and accepted will be on the record of the Congress and will be discussed. When several papers are received on any one general subject, the Commission reserves the right to have the papers presented as a resume, or in a synthesis of several papers.

Scientific principles should be, whenever possible, discussed with reference to application. Practical problems should be discussed with the indication of difficulties found in applying scientific knowledge. All committees encourage collaboration of scientists and technologists to prepare two complementary papers, or parts of a paper.

The time is not too early to plan for the trip and in the case of prospective authors, the manuscript. All requests at this time should be directed to H. Lillie, Chairman American Committee, 4th International Congress on Glass, Corning Glass Works, Corning, New York.

Research Digest • • •

(*Continued from page* 483)

glass as it passes through the orifice is unknown and little information is available on the effects of factors, such as color and surface tension. However, a fairly good estimate of the viscosity range covered may be made.

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Inventions and Inventors . . .
(*Continued from page* 492)

is difficult to keep them exactly in their desired positions. The example is shown by the drawing in Fig. 8. The elementary mirrors 1 are of trapezoidal outline. They are assembled by groups of twenty. Every group of twenty mirrors 1 is carried by a supporting plate or frame plate P_1, P_2 or P_3, itself of trapezoidal outline (with the bases in the form of circular arcs). These frame plates are mounted on a fixed framework so that the composite surface formed by the elementary mirrors is substantially the above-mentioned paraboloid. The fixed framework includes circular members C_1, C_2, C_3, C_4 carried by radial members R so that the circular members coincide more or less with circular sections of the paraboloid. A light source mounted at the focus of a parabolic mirror forms a beam of parallel light rays of a direction parallel to axis 21—21′ (not shown). This optical system is arranged to give, at focus, an image of an apparent diameter substantially equal to that given by the sun. Each of the elementary mirror plates is then adjusted separately so that it gives an image located exactly in the plane of focus. Owing to this construction, it is possible to constitute a composite mirror including a number of elementary mirror plates equal to only $\frac{1}{12}$ or $\frac{1}{15}$ of the number of mirrors which would be necessary if the elements were constituted by plane mirrors.

The patent contains three claims and the following references were cited: 1,794,103, Cubitt, Feb. 24, 1931; 1,951,404, Goddard, Mar. 20, 1934; 2,081,299, Hill, May 25, 1937; 19,732, Great Britain 1908 and 405,507, Italy, Aug. 17, 1943.

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Method of Forming Luminescent Coating. Patent No. 2,707,687. Filed August 30, 1951. Issued May 3, 1955. One sheet of drawings (none reproduced). Assigned to Westinghouse Electric Corporation by George H. Lockwood and Robert E. Peterson.

This invention relates to processes for coating vitreous surfaces with luminescent materials and, more particularly, to electric discharge devices whose interior surfaces are so coated. The luminescent powder is suspended in a lacquer comprising an organic binder, such as nitrocellulose, dissolved in a solvent, such as butyl acetate. To this suspension, partially hydrolyzed ethyl silicate is added. This final paint is then drawn up through the inside of the outer envelope and allowed to drain and dry. The outer envelope is then baked at a temperature at which the organic binder will be decomposed. The ordinary temperatures used to bake fluorescent bulbs, usually between 500°C. and 675°C., are satisfactory. The coating of luminescent material thus applied will not chip in service.

The patent contains one claim and the following references were cited: 2,151,496, Beese, Mar. 21, 1939; 2,329,632, Marsden, Sept. 14, 1943; and "Ethyl Silicate," Carbide and Carbon Publication 1945, page 10.

Method and Apparatus for Coating Hollow Glassware. Patent No. 2,697,025. Filed December 12, 1950. Issued December 14, 1954. One sheet of drawings (none reproduced). Assigned to General Electric Company by John W. Fulton and Arne Loft.

A method and apparatus for internally coating hollow glass articles, such as electric lamp envelopes, with a layer of minute light-diffusing particles, is shown. A combustible cloud-producing silicon compound (such as ethyl silicate) is finely atomized by a spray nozzle in the burner head to produce a flat-shaped spray which is ignited and burned in free space at a region removed from the burner head, thus spacing from the flame the parts of the burner which are cooler than the flame and substantially eliminating the formation and deposition of a hard ash or crust on the burner such as would otherwise interfere with the uniform operation of the burner. In addition, a cleaning jet of air or other substantially inert gaseous medium is directed along the discharge end of the burner spray head so as to substantially surround the same and to prevent premature vaporization of the ethyl silicate and keep the burner nozzles clean.

The patent contains 7 claims and 17 references were cited.

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Method of Making Tubular Glass-To-Metal Seals. Patent No. 2,697,309. Filed April 5, 1949. Issued December 21, 1954. One sheet of drawings (none reproduced). Assigned to Sylvania Electric Products Inc. by Paul E. Gates.

In accordance with the present invention, the glass tube and a metal sleeve are assembled coaxially, a tapered end of the sleeve having its reduced end projecting into a glass tube and having an enlarged portion engaging the end of the glass tube interiorly. In a sequence of heating steps, the end of the glass tube is softened while endwise pressure is applied to form the glass about the sleeve and then to form a seal. With sleeve tapers of approximately 10° to 30° and glass tubing of proper bore diameter, uniform and reliable seals are made without danger of the glass wetting the inner ends of the sleeves. This avoids the possibility of obstruction of the sleeve bore. The fabrication of a capsule requiring two sleeves is simply and expeditiously accomplished in like manner, the tapered surfaces of two sleeves being assembled coaxially with the glass, and sealed in a single sequence of operations that avoid separate handling of the sleeves and the glass in making the two glass-to-metal seals.

The patent contains seven claims and the following references were cited: 2,048,556, McArthur, July 21, 1936; 2,167,482, Hull et al., July 25, 1939; 2,271,657, Miller, Feb. 3, 1942; 2,386,820, Spencer, Oct. 16, 1945; 2,414,622, Watrous, Jr., Jan. 21, 1947; 2,457,144, Goodale, Dec. 28, 1948; and 616,065, Great Britain, Jan. 17, 1949.

Method of Making Seals for Composite Cathode-Ray Tubes. Patent No. 2,697,310. Filed June 29, 1951. Issued December 21, 1954. One sheet of drawings (none reproduced). Assigned to Radio Corporation of America by Richard D. Faulkner.

It has been determined experimentally that in the sealing of metal cathode ray tubes, the primary cause for failure of the seal arises from the fact that while the face plate is predominantly in radial compression, a portion is in tension. A feature of the invention, therefore, is the provision of methods of making an improved seal between the face plate and metal member of a composite glass and metal cathode ray tube. In this manner the metal member is provided with a rim portion having a sealing land and the seal between the face plate and metal extends not only along the sealing land but also for an effective distance along the mantle or main body portion of the metal member. The seal is effected in such a manner that the glass wets and seals not only the flange or sealing land but also a portion of the metal member adjacent the sealing land. Cathode ray tubes constructed in accordance with the improved face plate mantle assembly are not subject to seal failure or popping-out of the face plate.

The patent contains five claims and the following references were cited: 2,296,307, Power, Sept. 22, 1942; 2,318,653, Wiener, May 11, 1943; 2,518,690, Holman et al., Aug. 15, 1950 and 583,242, Great Britain, Dec. 12, 1946.

● Edward H. Morse has been appointed manager of The Baltimore Maryland Branch of the Glass Container Division, Owens-Illinois Company.

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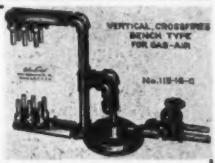
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